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Terrestrial Models: Introduction and MAIN programs

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TERRESTRIAL MODELS:
Introduction and MAIN Programs

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I

TERRESTRIAL MODELS

INTRODUCTION

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These models are intended to predict the values of a wide range of variables in the system simultaneously. They may be expected to lack the precision possible in a model intended for a special purpose; but by easy modification (module replacement - see below) they can serve special purposes reasonably well. The fact that all elements in the system are considered simultaneously makes it possible to do a variety of tests to which special-purpose models would not lend themselves, and thus they may serve as a guide to research priorities.

Modular Structure

The models can be conceived as composed of a set of modules which act as "black boxes" to one another. For each, the inputs and outputs are determined by the general characteristics of the system, so that it operates on inputs and provides outputs which are part of the common "language". Internally, each of the modules or submodels may have a great variety of structure but this is a matter of indifference to the rest of the model, to which it is simply a "black box".

The modules are concerned with the various component parts, or sets of processes in the system. Initially, these are the plants; the animals; and the soil plus the decomposers inhabiting it. These modules or submodels may be further subdivided as required. Each submodel is developed at different levels of detail, complexity, and sophistication, and these alternative submodels can then be combined freely to give models which may be highly sophisticated in respect of some components, simple in others.

Submodels Differing in Degree of Sophistication

The alternatives to be explored in submodel development cannot all be laid down in advance. It is clear, however, that extremely simple submodels may be required for parts of the system which have little influence on the processes on which attention is currently concentrated and within the time scale considered. For instance, it may be possible to rely on an unrealistically simple submodel for soil erosion where the main subject of interest is the feeding of herbivorous insects during a single summer. It may even be possible to ignore it completely-- to replace this submodel by a null or dummy version which generates no changes whatever. But the legitimacy of this simplification cannot be judged except by comparison with a more sophisticated and realistic submodel. If replacement of the more sophisticated by the less sophisticated version has only negligible effects on the processes of interest then the latter may be accepted for the immediate purpose.

With these considerations in mind, it is intended to develop for each submodel a series of alternatives, differing in the degree of detail and sophistication, and also in the particular emphasis of the sophistication. The less realistic ones are likely to be used only where those subsystems are of less interest, and when the time scale is relatively short

In early development of the submodels, the simplest versions ignore taxonomic differences, reproductive processes and spatial heterogeneity. Later versions will introduce these complexities in various combinations. The value of the complexities for the different purposes for which the model may be used will then be tested by omitting them one by one, so that a high degree of realism is retained in the model only where it is requisite for the purpose on hand.

The Variables

Wherever possible, all variables are expressed per unit area. The main state variables modelled are the quantities (per unit area) of different chemical constituents in different components of the biomass, which may be divided in a great variety of ways; in the components of litter, detritus and other dead material (which may also be subdivided in various ways); and in the soil

Population data and their changes may also be included, but are expressed as real variables representing an average per unit area rather than integral variables for a specific delimited region.

The exogenous variables used in the early models include daily precipitation, mean monthly day and night air temperature, monthly means for daily average and maximum wind speed, mean monthly radiation and photoperiod, mean daily rates of pan evaporation, and specifications of any run-on events, including material imported with the water and its composition. This list is subject to expansion

Classification of Variables

In any ecosystem, the variables characterizing it may be classified in different ways for different purposes. Apart from the biological classification itself, one may classify different parts of the system as organ types, by age or stage of development, or their topographical location, or one may classify variables according to whether they are quantities of chemical elements or population data. Plant and animal species may be classified not only according to their taxonomic position, but also by life form, feeding habits, life history, etc. And all these different cross-classifications may be relevant to some part of the functioning of the ecosystem -- some of the processes leading to changes in the values of the state variables.

Cross-classification of state variables (and of some of the parameters of the system) is accordingly a dominant feature of the models. This makes it unnecessary to describe separately the processes in which each state variable is involved. Instead, it is necessary to give separate specifications only for those classifications and classes which are relevant to the particular process in question, all other classificatory subdivisions of the state variables being ignored for this purpose. If, for instance, for a particular animal species, feeding habits are the same for mature and immature individuals, then the model uses a common description for feeding processes of the different age categories, while in that part of the model describing reproductive behaviour it is clearly of first importance to distinguish these age categories.

Functional Forms

Most of the variables being real, and most changes being continuous, it is usually appropriate to describe the rates of change in terms of differential equations - and, in general, ordinary first-order differential equations, in which each derivative is directly or indirectly a function of state variables and exogenous variables. No restriction is placed, however, on the type of functions used; they may be linear or non-linear, with or without constraints. One very common type of constraint is imposed by the fact that most of the state variables (biomass, population, etc.) must in their very nature be non-negative, so that the derivative must be non-negative where the value of a state variable is zero.

Though differential equations are the commonest way of representing changes in the model, functions involving discontinuities (such as may be imposed by threshold values of influencing variables) or representing discrete processes are fully acceptable. The general structure of the models is also fully compatible with the introduction of stochastic elements in one or more of the submodels, as well as in exogenous variables.

The Computer Implementation

The computer representation of these models is written in FORTRAN IV. The intention has been to avoid features of FORTRAN IV which might be peculiar to specific machines or installations so that the models developed might be widely usable.

The computer programs include a general calling program which handles most of the input and puts together the results provided by a number of subroutines. Each of the latter represents a submodel, and they may be nested if the submodels are further divided. There is also a subroutine for input of exogenous variables. Output (handled by special subroutines) takes the form of tabulations of the values of all state variables at particular dates, together with graphs of the time course of particular state variables through the period of simulation.

The programs are written, as far as possible, in general terms so that they may be applied with minimal modification to a wide variety of ecosystems. In particular, the number of classes in each cross-classification of the data, and their designations, are left to be decided at execution time, and facilities are also provided for specifying or modifying the parameters of the system then.

For computer solution, the differential equations expressing the rates of changes in the state variables are replaced by difference equations over a time unit fixed for the submodel, but not necessarily uniform over all submodels. If the approximation by difference equations over this time leads to negative values of an essentially non-negative variable, the program reduces the time unit as required.

Besides the changes in state variables, the program also keeps a record of the total exchange of the ecosystem with its environment, in terms of each of the constituents (chemical elements, water, and/or energy) included among the state variables, and distinguishes between exchanges with the atmosphere, with the sub-soil or by surface flow with laterally adjacent areas.

Descriptions of Models and Submodels

Standardized descriptions of the models are being prepared for distribution. Though the computer programs implementing the models will also be included in these descriptions, their primary purpose is to describe the model itself in verbal and mathematical terms rather than the computer program - which can speak for itself to those who are interested in the implementation as well as in the conceptualization.

After a brief introduction, the description will detail the assumptions incorporated into that particular model, and will then describe the way in which the various processes are treated. For each process, supplemented where appropriate by graphs, a verbal description will be followed by a mathematical representation of the differential (or other) equations incorporated in the model. For these mathematical representations (which can be skipped by readers who are not mathematically oriented), a standard symbolism has been developed. Since the number of distinct variables and parameters required with proliferation of further submodels may be very large, it is not expected that it will always be possible to use consistently the same symbols for the same variables (or parameters) in all models, though this will be done as far as possible. Consistency is, however, being sought in respect of the classes of symbols, and in the use of sub-scripts, as follows:

1. State variables are designated by X subscripted to indicate the particular state variable in question. It is intended to reserve X_1 .... X_9 for state variables within the plant subsystem, X_{11} .... X_{19} for those within the animal subsystem, and X_{21} .... for those concerned with soil micro-organisms, or non-living components of the system. It will be convenient to consider the exterior as specified by a series of dummy state variables, whose absolute values may be meaningless, but changes in which represent the exchanges of the ecosystem with its environment. These dummy variables will be represented by X_0 .... X_{09}.

2. Rates of change in state variables are represented by a superposed dot, as:

$$\dot{X}_2 = \frac{dX_2}{dt}$$

3. Parameters of equations in the system - values not changed by the system, though sometimes varying in step-wise fashion - are indicated by a P. as:

$$P_7$$

4. Exogenous variables are signalled by a V, for instance:

$$V_{12}$$

5. Temporary variables - variables required in the course of calculation, or for purposes of explaining an algorithm - are designated by a subscripted Z, as:

$$Z_2$$

6. Output variables - those calculated from state variables for output purposes only, and playing no part in the dynamics of the system - are signalled by Y, as:

$$Y_3$$

7. Subdivision of the rate of change of a state variable is represented by an italic capital used as a prior subscript. Thus, ${}_{H}X_2$ may represent that part of the change in X_2 is attributable to herbivory.
8. Classes of variables or parameters are indicated by lower-case italic letters used as posterior subscripts. Thus, for a state variable classified in two ways (say, by plant species and organ,)

$$X_{8_{pg}}$$

would represent its value in the *p* th species and the *g* th organ. The same subscripts may also be applied to parameters.
9. The following posterior subscripts have been standardized:

a	animal species or group
c	animal cohort
d	type of dead organic material (litter)
f	chemical fractions (constituents)
g	plant organ or portion
h	soil horizon
p	plant species or group
r	route or exchange at ecosystem boundaries
s	plant stage of development

10. For certain of these subscripts, different values have meanings which have been standardized in the descriptions of earlier versions of the submodels, as follows:

Chemical fractions or constituents

$f = 1$ Nitrogen
$f = 2$ Ash constituents
$f = 3$ "Active" carbon (carbon in metabolically active compounds including proteins and enzymes)
$f = 4$ "Reserve" carbon (carbon in carbohydrates, fats, glycogen, and other storage compounds)
$f = 5$ "Structural" carbon (non-metabolizable carbon components that make up the structure of individuals such as bones, hair, skin, in animals; cellulose and lignin in plants)

Plant Organs

$g = 1$ Leaves
$g = 2$ Young stems (current year's growth)
$g = 3$ Older stems and bases
$g = 4$ Inflorescences
$g = 5$ Seeds
$g = 6$ Roots in different soil horizons
etc.

Types of Dead Material

$d = 1$ Standing dead herbaceous material ("fog")
$d = 2$ Standing dead woody material
$d = 3$ Soft plant litter
$d = 4$ Woody plant litter
$d = 5$ Soft animal parts
$d = 6$ Animal skeletons
$d = 7$ Excreta
$d = 8$ Dead roots in different soil horizons
etc.

Route of Exchange

$r = 1$ Atmosphere
$r = 2$ Soil surface
$r = 3$ Sub-soil

11. Where it is useful to define a subset of subscript values, this subset is symbolized by an italic capital. Thus, of the set of chemical fractions or constituents indicated by the subscript f the subset containing the carbon fractions only is designated by

$$C = \{3,4,5\}$$

The subset of elements other than carbon is designated by

$$M = \{1,2\}$$

Operations limited to subset of values are indicated by the symbol ε; thus,

$$Y_p = P_{1_p} X_{1_{pgf}} \quad , \quad p \in A$$

indicates that this function applies only to cases where the subscript p is included in the subset A; and

$$\sum_{p \in A}$$

indicates that summation is limited to these cases.

12. Some readers may not be familiar with the pi-product notation, parallel with the sigma notation for summation; thus,

$$\prod_{p=1}^{n} X_{1_{pgf}} \equiv \prod_{p} X_{1_{pgf}} \equiv X_{1_{1gf}} \cdot X_{1_{2gf}} \cdot X_{1_{3gf}} \cdots\cdots X_{1_{ngf}}$$

and $\prod_{p \in A} X_{1_{pgf}} \equiv X_{1_{2gf}} \cdot X_{1_{4gf}} \cdot X_{1_{7gf}}$

where the subset A is defined as:

$$A = \{2,4,7\}$$

13. Other conventions used consistently include the following: exp is an abbreviation for "exponential"; i.e.

$$\exp(a) = e^{a}$$

ln is used for the natural or Napierian logarithm:

$$\ln(a) = \log_e a$$

max is the abbreviation for the maximum and min is an abbreviation for "minimum"; thus,

$$\min (X_4 , X_5)$$

indicates the smaller of the values X_4 and X_5, while

$$\max (X_4 , X_5)$$

indicates the larger of the two values. A subscript placed below max or min:

$$\max_{f} (X_{12_{sf}} / Z_{9_{sf}})$$

indicates that the expression which follows it should be evaluated for all values of the subscript, and the largest (or smallest) of the resulting quantities taken.

The description of the processes in the model is followed by a list of the symbols used, with definitions and FORTRAN equivalents. There is then some discussion of constraints imposed on the model by the existing computer program, particularly by array dimensions, and changes which might be required to enable it to meet other needs. A flow diagram of the program, and a listing follow, with examples of data used, and of output. The time needed for running the program on a standard installation is also indicated, together with its storage requirement.

CALLING PROGRAM AND INPUT/OUTPUT SUBROUTINES

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CALLING PROGRAM

INTRODUCTION

The computer program to be described in this report provides a common framwork for the terrestrial models to be developed. It does not itself model the dynamics of the system - a task performed by subroutines, which may be varied independently of the main program and of one another. The main program described below organizes most of the input operations, including the calculations of quantities required only as collective input to the subroutines, and performs the incrementation of the state variables in accordance with calculations performed by the subroutines. This program can be combined with various sets of subroutines to form any particular model to be executed.

The program is designed to cover a wide range of terrestrial ecosystems in which the state variables consist of the weight of various chemical constituents contained in plant material, subdivided by species or species group, by stage of development and by organ group; animals, subdivided by species or species group and by stage of development; different types of litter; and soil organic matter. The state variables also include the population of each animal group, and available soil nutrients, together with soil water tension. The soil state variables and others associated with the soil (e.g. roots, and seed reserves) are divided by horizons. Additional state variables may be introduced by the subroutines. The main program then treats them in the same way as the other state variables, and provides facilities for printing them out if wished. Exogeneous variables are acquired through the subroutine EXOGEN, while output is organized by the subroutines REPORT and GRAF.

The parameters of the system (i.e. the constants incorporated in the equations expressing rates of change in the state variables) do not figure in this program, but are introduced into the programs implementing the process submodels, which are called as subroutines in the course of the main program discussed below.

INPUT ORGANIZATION

The successive cards required for input, many of which are optional and determined by the special requirements of the model in question, are detailed below. Constraints are placed on these input data by the array sizes of the program as complied. These constraints are described in a later section of this report.

I. COMMENTS AND TABLE HEADING

Any comments which it is wished to associate with the output may be printed out before the rest of the output by inserting cards bearing the comment information at the beginning of the input deck. These cards should finish with a blank, or be replaced by a blank if no comments are needed. The blank ending the comments is followed by a single card providing a heading for tabular output.

II. INSTRUCTIONS CARDS

a. Dimensions, Specifications, Input/Output Instructions and Switches

The next three (+) cards contain (in (16I5) format) the following information in successive fields of five columns, right-justified:

Card A

1. The number of plant species or species groups.
2. The number of animal species or species groups.
3. The number of plant organs or organ groups distinguished.
4. The number of carbon fractions separated.
5. The number of chemical elements (excluding carbon if the figure in IIa(4) was positive.)
6. The number of types of dead organic material distinguished.
7. The number of different names to be read in for animal cohorts or stages of development.
8. The number of different names which are to be read in for stages of development of the plants.
9. The number of horizons distinguished for soil variables.
10. The number of soil horizons distinguished for seed records (see VIIb below). If non-positive, this value is interpreted as unity.
11. Number of categories for dry-matter calculations (see V below).
12. The time step for simulation (in thousandths of a day); if this field is non-positive, the time step is taken as one day.
13. The number of entries in the "instructions" array (see IIb below) to be passed to the subroutines.
14. The number of entries in the "Repetitions" array, determining the time units for the subroutines (see IIc below); if this value is zero, all subroutines are assumed to use the same time unit as the main program - that specified in (12) above.

Card (s) B

15. The starting date of the run, counting from the beginning of the year.
16. The year in which the run is to begin.
17. The number of the day on which the run is to finish, counting from the beginning of the year in which the run starts.
18. The number of tabulated reports required after the initial report.
19. The number of line graphs required.
20. The number of block graphs required.

If the value at (17) is positive, one or more further cards are read in giving the dates (calculated from the beginning of the year in which the simulation starts) at which tabulated reports will be required. The number of such entries will be equal to the figure in (17). If (17) is blank, only initial and final reports will be provided (but see (25) below).

21. A switch for debugging purposes; if this is positive, extra information is printed out by many of the subroutines in the course of their operation, from the day of simulation it specifies.
22. A switch to complete the debugging operation begun under the previous instruction. If this value is less than that in the previous field, the debugging operation will continue to the end of the run.
23. A switch for timing purposes; if this switch is zero, no timing information will be included in the output; if it is set at "1", timing information will be given for each report and graph produced; if it is set at "2", the C.P.U. time for each time unit simulated will be reported
24. A switch which must be positive if sensitivity tests are to be performed.
25. A switch for tabular reports:
    0: Initial and final reports, together with reports on any intermediate dates specified.
    1: Only the initial report is required.
    2: All tabular reports are to be omitted.
    3: The initial report is to be omitted.
26. A switch to provide (when positive) for the printing, with the tabulated reports, of any additional state variables initiated by the process subroutines and stored in the array DUMMY.
27 This and the next field give facilities for a portion of the parameter list to be printed before simulation starts. If the value in this field is positive, it causes values in the block / PARAM /, from this address onwards, to be printed out as soon as they have been read in by the process subroutines.
28 This field gives the last address for values in the COMMON block / PARAM / to be printed out under control of the switch in IIa (27) above.
29. A switch to provide (when positive) for the state variables to be read (in binary form) from a mass storage file designated as Unit 9, instead of from cards.
30. A switch to provide for the state variables to be dumped at specified times, in binary form, into mass storage files designated as Unit 10, Unit 11, etc. The number of such dumps is punched in this field.
31. If the previous field (IIa (30)) is occupied, the dates (from Jan. 1 in the first year of simulation) on which dumps are to be made are specified in these fields. The dates must be in order, and the number of fields occupied is equal to the number in (IIa (30)).

b. Instructions to Subroutines

If (IIa (13)) is positive, a further card is read in containing a number of integers equal to the value in this field, in (16I5) format. These entries may be used for communicating with subroutines at execution time, and conveying instructions modifying their mode of operation.

c. Repetitions of Subroutines

If (IIa(14)) above was occupied by a positive value, a series of cards equal in number to the value in this field is read in. Each of these cards has in the first field of five columns a number, right-justified, representing one of the subroutines ("1" for VEGET, "2" for ANIMAL, and "3" for SOILS; other designations will be alloted later as required); the second field of five columns (6-10) contains, similarly right-justified, the number of times this subroutine is to be repeated within each of the time units simulated - or, in the case of a nested subroutine, within each operation of the subroutine which calls it. In other words, this provides a facility for varying the time units within subroutines, but limited to integral submultiples of the time unit used within the main program.

III. STAGES OF DEVELOPMENT

a. If the value in IIa (8) is greater than one:

1. A card is read in with the number of distinct stages of development for each species of plant, in (16I5) format. The number of entries should equal the number of plants or groups in IIa (1).
2. This card is followed by one card for each species defined in IIIa (1) as having more than one stage of development, and less than the maximum number specified in IIa (8). Each of these cards contains, in (16I5) format, the numerical designations of these stages of development, corresponding with the names to be used for them in output (see IVe below).

b. If the value at IIa (7) is positive,

1. A card in (16I5) format is read in giving the number of stages of development for each animal species or group, as for plants in IIIa (1). The number of entries should equal the number of animal groups specified in IIa (2).
2. This is followed by cards specifying the numerical designations for animal stages of development, as in the case of plants at IIIa (2) above.

IV. NAMES

a. If plants occur in the system (if the value at IIa (1) is positive), the names of plant species or groups are read in, two to a card, with up to 28 characters for each (i.e., the fields used are columns 1-28, and columns 29-56). The number of these names should correspond with the value in IIa (1).

b. If there are animals present (if the value at IIa (2) is positive), the names of animal species are read in, in the same way as those for plant species. They should correspond in number with IIa (2).

c. If plant organs are to be distinguished (i.e. if the value at IIa (3) was positive) the names of these organs or organ groups are read in, three to a card, with up to 24 characters for each (i.e., the fields used are columns 1-24, 25-48 and 49-72). If soil horizons are distinguished (if the figure at IIa (19) is greater than one) roots in different horizons are treated as distinct organ types, and follow the aerial organs.

d. The names of chemical constituents are read in, up to 12 characters for each, in (20A4) format. Carbon fractions should follow the other constituents; if total carbon is included rather than carbon fractions, it has the last place in the list. The total number of constituents is the sum of the numbers at IIa (4) and IIa (5).

e. If the value at IIa (8) is greater than one, the names of the stages of development for plants are read in, five to a card, each with up to 16 characters (i.e., the fields used consist of columns 1-16, 17-32, 33-48, 49-64, and 65-80). The number of entries is equal to the value at IIa (8).

f. If the value at IIa (7) was greater than one, the names of stages of development for animals are read in, in the same way as those for plants in IVe above.

g. If the value at IIa (6) is positive, the names of different types of dead material or litter are read in, three to a card, using columns 1-24, 25-48 and 49-72 If soil horizons are distinguished (i.e., if the figure at IIa (9) is greater than one), categories of dead material (e.g., dead roots) located in different horizons are treated as different types of litter. The number of entries is equal to the value in IIa (6).

V. DRY MATTER CONVERSIONS

Total dry matter in the various compartments of the system is estimated by a linear function of the various chemical constituents. This section provides the coefficients necessary for these calculations.

a If the value at IIa (11) is positive, a card in format (16I5) is read in specifying for the different categories of dead material which set of dry-matter conversion factors is to be used. The number of entries is equal to the value in IIa (6).

b. Three or more cards (in (8F10.2) format) are read in, each of which specifies a vector of multipliers, equal in number to the sum of the values in IIa (4) and IIa (5), which are to be used for multiplying the chemical constituents to estimate the dry weight of the different organic components of the system. These cards should equal in number the value in IIa (II) if more than three. The first card contains the multipliers to be used for plant material, including seeds; the second is for animal tissue; the third for soil organic matter. Additional cards may be read in if different sets of multipliers are required for certain categories of dead material.

VI. TYPES OF DEAD MATERIAL, AND SOIL HORIZON DEPTHS

a. The next card divides the categories of dead material (whose overall number has been specified at IIa (6) into three classes; above the soil, on the surface, and beneath the soil. Six integers (in (16I5) format) give the beginning and ending point in the sequence of dead material categories for each of those three classes in succession.

b. If the value at IIa (10) was greater than one, a card is read in with the lower limit (in mm. depth) of each soil horizon below the surface for which seed populations are distinguished. The number of entries required is equal to than the value at IIa (10).

c. A card is read in with the lower limit (in mm. depth) of each soil horizon distinguished, in format (8F10.4). The number of entries should equal the value in IIa (9).

VII. INITIAL VALUES OF STATE VARIABLES

The cards in this section give values for the state variables at the starting point of the simulation. Most of them contain the quantities per unit area ($g.ha^{-1}$) of the various chemical constituents, in the same sequence as in IVd. All are in (8F10.2) format.

a. For each stage of development of each plant and each of the organ types, a card is read in with the initial values of chemical constituents per unit area of ground (i.e., $g.ha^{-1}$). The first stage of development of the first species is taken first, and cards equal in number to the number of organs (IIa (3) above) are read in; these are followed by a similar set for the second stage of development of the first species, the third stage of development of that species, and so forth; then there follows a set of cards for the different organs in the first stage of development of the second species, etc. The total number of such cards should accordingly be the product of the value at IIa (3) by the sum of the values in IIIa (1).

b. Cards are read in containing figures for the initial quantity per unit area of the various chemical constituents contained in viable seeds on or in the soil. These cards are equal in number to the product of the number of plant species or groups (IIa (1) above) by the number of horizons distinguished (IIa (10)). A set of cards for the first plant species, each card representing successive horizons from the surface down, is followed by a similar set of cards for the second species, and so forth. Each card contains the quantities of chemical constituents per unit area (in $g.ha^{-1}$) for seed of that species in that horizon.

c. For each animal species a series of cards is read in giving the population and biomass. The first card for each animal species contains the population figures for successive stages of development, the number of such figures being equal to the corresponding entry in IIIb (1); this is followed by a sequence of cards, each containing the quantity of chemical constituents for the successive stages of development. The total number of cards for animal data is thus the sum of IIa (2) and the total of the figures in IIIb (1).

d. One card is read for each of the litter types, giving the quantity of the various chemical constituents per unit area. The total number of such cards is equal to the figure in IIa (6).

e. A series of cards equal in number to twice the figure in IIa (9) gives the quantity of chemical constitutents per unit area in the soil in successive horizons. The first two cards give the composition of the uppermost horizon.
   1. The first card specifies the constituents of the organic matter fraction, equal in number to the sum of figures in IIa (4) and IIa (5).
   2. The second card gives the chemical elements (equal in number to IIa (5)) present in inorganic form, followed by the water content of that soil horizon soil in mm.

   These two cards are followed by similar pairs of cards for successively deeper soil horizons.
   3. A final card gives the depth of the snow cover if any (in mm.) and its weight (in $g.ha^{-1}$), and any free water over the soil surface (depth in mm.)

VIII. SPECIFICATIONS FOR GRAPHICAL OUTPUT

a. If the value at IIa (18) is positive, a series of cards are read in specifying the line graphs required. For each of the graphs in succession, the following cards are needed:
   1. A card specifying which variables are to be graphed. These are expressed as addresses in the state variables array (COMMON block / STAT /); the addresses in the sum array (COMMON block / TOTALS /) increased by 10,000; the addresses in the external exchange array (COMMON block / ACC /) increased by 20,000; or the addresses in the array of additional accessible variables (COMMON block / OTHER /) increased by 30,000. These addresses are punched in (16I5) format, and may not exceed eight in number for each line graph.
   2. A title card for the graph; all 80 columns may be used.
   3. A title for the Y-axis of the graph (the X-axis always being in days). This title may occupy columns 1-40 of the card. If the word "ZERO" is punched in columns 41-44, the Y-axis of the graph will include zero; otherwise, it will extend from the minimum to the maximum value of the variables graphed.
   4. If VIIIa (1) designates more than one variable, these are followed by a series of cards equal in number to the entries in VIIIa (1). Each card gives a brief explanation of one of the variables included in the graph, in the same order as their addresses are listed in VIIIa (1). Twenty characters are allowed for each, which should be in columns 1-20 of the card.

5. If the value at IIa (19) is positive, a card is read in giving the addresses of the variables for which block graphs are required; these addresses are coded according to the same rules as in VIIIa (1). This card is followed by two cards for each of the block graphs, the first being a title, the second a title for the Y-axis limited to the first 40 columns of the card.

IX. INPUT REQUIRED BY SUBROUTINES

a. Each of the process subroutines may require parameters, and other specifications to be read in. This takes place after all the preceding input requirements have been met. Where such information is needed, reading is performed by a NAMELIST statement. The first card for each reading operation begins with

b$NAMEb

where NAME represents the name of that NAMELIST in the subroutine in question, and b represents a blank column. This and subsequent cards then contain entries in the forms:

A = *a*, B (3) = *b* , C = *c*, *d*, *e*, n * *f*,

where A is the name of a variable and B and C are names of arrays included in the NAMELIST; *a*, *b*, *c*, *d*, *e*, *f*, are constants of the appropriate type; and n is an integer. Each NAMELIST input is concluded with

b$END

For this purpose, the process subroutines are called in the order VEGET, ANIMAL and SOILS.

b. Specifications for sensitivity tests are then read in. These are discussed in the report on the sensitivity subroutines.

c. Finally, information on the exogeneous variables is read in. This input is discussed in connection with the EXOGEN subroutine below.

COMPUTATIONAL OPERATIONS

The central part of the program is responsible for incrementation of the state variables. When calculation of all the increments over a single time unit (of which sub-multiples may be used for some of the subroutines) has been completed, they are tested to ensure that none of them would cause state variables to become negative, where this constraint is appropriate (which is true of most state variables in ecological systems). If some of the negative increments are "too large" in this sense, all increments are scaled down in such proportion as the most limiting constraint requires, the increments are applied to all state variables, and the subroutines are called again for recalculation of increments. These increments are then multiplied by the complement of the proportion already applied to the state variables, and the test of their magnitude is repeated. The process continues until a set of increments can be applied *in toto* Briefly, this is equivalent to dividing the time unit over which the difference equations approximate the underlying differentials into arbitrary portions such that the constraints can be met. This process, central to the program, may be represented as follows: Let X_{ij} be the value of the i'th state variable at the beginning of the j'th iteration, and ΔX_{ij} the increment for one time unit as calculated by the subroutines for that iteration. Then:

$$X_{i,j+1} = X_{i,j} + t_j \, \Delta X_{i,j}$$

where: $$t_j = -(\min(-1, \frac{\Delta X_{ij}}{X_{ij}}))^{-1}$$

Iteration is completed when: $\sum_j t_j = 1$

In order to avoid difficulties when a state variable gradually approaches zero, a limit is set below which any state variable is arbitrarily set to zero. Moreover, if one constituent of any biological compartment is zero, it is assumed that all other constituents are also zero, and they are set accordingly. Exchanges between the ecosystem and its surroundings are accumulated by the calling program from data provided, time unit by time unit, by the subroutines. These quantities, together with any state variables not constrained to take non-negative values, are incremented in proportion to the increments mentioned in the previous two paragraphs, so that the whole program is operating in time units shorter than that prescribed whenever this proves necessary.

An exception to the general treatment of state variables is the soil water tension for each horizon, which is calculated afresh by the SOILS subroutine for each time unit, rather than being changed by the main program by the addition of an increment calculated by the subroutine.

Sums of state variables for all classes and combinations of classes are required for output, and may also be needed by the subroutines. These summations are accordingly performed by the main program initially, and again after each time unit of the simulation has been performed. Exchanges with the surroundings of the ecosystem-- with the air, with the subsoil, and along the soil surface-- are also accumulated after each time unit.

Array Dimensions

The use of the program is limited by the dimensions allotted to the arrays, and these limitations need discussion so that the user may be in a position to modify them as his particular requirements indicate. On the next page is a list of arrays included in the calling program, in which the dimensions which may appropriately be varied are indicated by letters. Dimensions of other arrays, and dimensions indicated by numbers, are subject to other constraints, and changes in them would call for other changes in the program.

ABIOM (a)
ABIOSP (b)
AGAIN (c,d)
AGAINQ (c,d)
ALINAM (e,6)
ALIT (c)
AMAXI (f)
AMINI (f)
ANIM (b,h)
AORG (i)
ASEED (j,k)
ASEEDH (j)
ASEEDV (k)
ASPNAM (b,7)
AVEG (m,n)
AVEGO (m)
AVEGV (n)
CBIOM (a,h)
CBIOMN (h)
CBIOMQ (a,h)
CHNG (x)
CLIT (e,h)
CLITT (h)
CLITQQ (e,h)
CMIN (i,h)
CMINH (h)
CMINQQ (i,h)
COHNAM (p,4)
CORG (i,h)
CORGH (h)
CORGQQ (i,h)
COVER (j)
CVEG (m,n,h)
CVEGO (m,h)
CVEGQQ (m,n,h)
CVEGV (n,h)
CVEGVO (h)
DECINC (r)
DRYFAC (t,h)
DUMMY (o)
DUMMYQ (o)
DUSCOM (h)
EROD (c)
ERODQQ (c)
EXPLA (5,v)
EXPLAN (5,g)
FIG (v,70)
FIGS (g,70)
FRANAM (h,3)
HORDEP (q)
H2O (c)
H2OQQ (c)
INSTRU (y)
LIGRAF (g)
LISCOH (a)
LISTER (f)
LISVCO (m)
LITCAT (e)
LITRUN (e)
MREP (z)
NCOH (b)
NCOHCU (b)
NREPET (u)
NVCOCU (j)
NVCHO (j)
ORGNAM (n,6)
ORICIN (f)
POP (a)
POPQQQ (a)
POPSP (b)
SAVEG (j,n)
SAVEGO (j)
SEED (j,k,h)
SEEDEP (k)
SEEDH (j,h)
SEEDQQ (j,k,h)
SEEDV (k,h)
SEEDVH (h)
SOILTE (i)
STATE (r)
STNG (x)
SUMS (w)
SVEG (j,n,h)
SVEGO (j,h)
TITLES (f,20)
TOT (h)
TOTAL (h)
VCONAM (s,4)
VSPNAM (j,7)
WATABS (i)
WATABQ (i)
WATER (i)
YAXISS (f,10)

The dimensions indicated by letters define the maximum values possible for the following quantities defined below. Most of these quantities correspond with limits for DO-loops in the FORTRAN program, and the names for these limits are also tabulated to the left.

a:	Total number of animal cohorts.	NSPECA
b:	Number of animal species (or groups).	NCHAN
c:	Number of channels for gain or loss to or from the system.	NELEM
d:	Number of chemical elements.	NOLIT
e:	Number of types of dead material.	NOHISU
f:	Number of separate graphs.	
g:	Number of variables to be graphed.	
h:	Total number of chemical constituents (carbon fractions, if any, <u>plus</u> other elements.)	NERELM
i:	Number of soil horizons (see also q below).	NHORIZ

j:	Number of plant species (or groups)	NSPECV
k:	Number of soil horizons for seed records.	NSEEDH
m:	Number of plant cohorts.	NVECOH
n:	Number of plant organ types	NORGAN
o:	Extra addresses for state variables and increments available to process subroutines in arrays DUMMY and DUMMYQ	
p:	Number of different names for animal cohorts.	NCOHOR
q:	Soil horizons, plus 1 (i.e. q = i + 1)	NORZI
r:	Total number of "words" in Common Blocks STAT and CHANGE.	LIMIT
s:	Number of different names for plant cohorts.	NVCOHR
t:	Number of different dry-matter conversion functions	NDRCAT
u:	Number of process subroutines.	NOTIME
v:	Number of curves on a single graph.	
w;	Total number of "words" in Common Block TOTALS.	LIMTOT
x:	Total number of "words" in Common Blocks ACC and ACCINC; this dimension should equal the value defined for LIMACC.	LIMACC
y:	Number of instructions to be transferred to subroutines.	NOINST
z:	Number of tabulated reports to be provided.	NREP

It should be noted that, if the dimensions of any of the arrays in the common blocks are changed, not only must these blocks be changed in any subroutines where they occur, but the arrays equivalenced with the common blocks must be changed to correspond, as also the variables specifying their limits, thus:

Common Block	Array	Limit
ACC ACCINC	STNG CHNG	LIMACC
TOTALS	SUMS	LIMTOT
STAT CHANGE	STATE DECINC	LIMIT

Arrays occurring in the paired common blocks ACC and ACCINC, STAT and CHANGE must correspond in their order and in all their dimensions, as tabulated below:

Arrays that must Match in their Dimensions

AGAIN	AGAINQ
CBIOM	CBIOMQ
CLIT	CLITQQ
CMIN	CMINQQ
CORG	CORGQQ
CVEG	CVEGQQ
DUMMY	DUMMYQ
EROD	ERODQQ
H2O	H2OQQQ
POP	POPQQQ
SEED	SEEDQQ
WATABS	WATABQ

SUBROUTINE EXOGEN

This subroutine provides for input of meteorological data initially, and for the supply of daily values of meteorological variables to the process subroutines requiring them. The input required by this subroutine occurs after all other inputs. Unless otherwise stated, all cards are in (8F10.2) format. The cards required are as follows:

1. Mean daily quantity of dust falling from the atmosphere in $g.ha^{-1}$.
2. Elemental composition of dust (for the same elements, and in the same order, as the ecosystem constituents in the main program), expressed in g. per g.
3. In (I5) format, the number of categories of dead organic material which may be imported by wind or with run-on water.
4. If the value in the previous card is positive, a list in format (16I5) of the litter categories which may be imported. The entries should equal in number the value at (3) above.
5. The mean elemental composition of precipitation (arranged as in (2) above) in $g.g^{-1}$.
6. A sequence of pairs of cards describing precipitation events. In each pair, the first card gives, in (15I5) format, the dates (in days from Jan. 1); the second card gives (in 15F5.1 format) the amount of precipitation on the dates listed - preceded by a minus sign if the precipitation occurred as snow - in mm water. Each of these cards has the year punched in columns 77-80. The cards must be in chronological order; years before and after the period simulated will be ignored. These precipitation records are ended with a blank card.
7. A set of cards describing deposition events. These cards are divided into groups each of which describes up to 15 deposition events taking place in the same year. Each group is made up as follows:
   a. A card giving the dates (in days from Jan. 1) of the events in question, in format (15I5).
   b. A card giving the amounts of water flowing on to the area, in tons ha^{-1}, during the events specified. If deposition is by wind, this card is blank.
   c. A card giving the amounts of mineral soil deposited, in tons ha^{-1}, during the events specified.
   d. Cards giving the amounts of mineral elements (as in VIIe (2) of the main program) deposited, in $kg.ha^{-1}$. Each card gives the quantities of a single element transported in the successive deposition events listed in 7(a).
   e. Cards giving the amounts of chemical constituents (as in VIIe (1) of the main program) deposited, in $kg.ha^{-1}$. Each card gives the quantities of a single constituent transported in the successive deposition events.
   f. If the value at (3) above is positive, cards are read in giving the amounts of chemical constituents transported in detritus, in $kg.ha^{-1}$. Each card refers to the sequence of deposition events in 7(a) above. The transportable

categories of detritus are taken in order, and for each the different chemical constituents are taken in order The total number of cards in this section is accordingly the product of the value at (3) and the sum of those at IIa (4) and IIa (5) in the main program description.

Each card in the set has the year to which it applies punched in columns 77-80. Similar sets of cards are read in for successive years, but cards for years outside the period of simulation are ignored. These run-on records are ended with a blank card.

The following cards are included on all occasions:

8. Two cards giving the monthly mean day temperature (in °C.)
9. Two cards giving the monthly mean night temperature (in °C.)
10. Two cards giving the monthly mean potential evapotranspiration (as measured, for instance, by pan evaporation) per day (in mm.)
11. Two cards giving the monthly mean photoperiod (in hrs.)
12. Two cards giving the monthly mean radiation intensity (cal.cm.$^{-2}$min.$^{-1}$).
13. Two cards giving the monthly mean water-vapor pressure (in mm. hg).
14. Two cards giving the monthly mean wind velocity (in m.sec^{-1}).
15. Two cards giving the monthly mean of daily maximal wind velocity (in m.sec^{-1}).

Operations

After input cards have been read in, control returns to the main program. The subroutine is called again at the entry point EXOGE2 whenever a new day is simulated. If rainfall or a deposition event occurs on that day, the appropriate values are transferred from storage to the METEOR common block. Similarly, every time the month changes the appropriate monthly means for the other meteorological variables are transferred.

Array Dimensions

Limitations imposed by dimensions for arrays used in the EXOGEN subroutine, but not in the main program, are as follows:

DRUNLT (e,f)	DRUNMI (d)	DRUNOR (f)
ERODED (b)	EXO (c)	LITRUN (e)
MRAIN (a)	MRUNON (b)	RAIN (a)
RUNLIT (b,e,f)	RUNMIN (b,d)	RUNON (b)
RUNORG (b,f)		

where the dimension symbols have the following meanings:

Dimension	Definition	FORTRAN
a:	Number of days with precipitation during the period simulated + number of years -1	NRAIN
b:	Number of days with run-on during the period simulated + number of years -1	NRUNON

Dimension	Definition	FORTRAN
c:	Total number of words in Common block METEOR	LIMEXO
d:	Number of chemical elements	NELEM
e:	Number of transportable categories of dead material	NRUNLT
f:	Total number of chemical constituents (carbon fractions, if any, plus other elements)	NFRELM

Other dimensions are constrained by other features of the program, and may not be varied so readily.

N.B. If any dimensions within the Common block METEOR are changed, that of EXO with which it is equivalenced must also be changed to correspond; a value equal to the dimension of EXO must be given to LIMEXO, and the value of LIMEXI should be the address of ERODE in the Common block METEOR.

SUBROUTINE REPORT

At times when tabulated output has been requested, the values of all state variables are printed together with their sums. In addition, estimates of dry matter of the various compartments are provided, these being calculated from an expresion:

$$Y_{ij} = \sum_k P_{ik} X_{ijk}$$

where k ranges over the chemical constituents included in the model, and where suffix i indicates which set of multipliers P_{ik} (read in at V(c) in the main program) is appropriate (i = 1 for plant tissue; i = 2 for animal tissue; i = 3 for soil organic matter; and, for the various types of dead organic material, i is as specified in V(a) in the main program).

The tabulated output also includes, on all occasions except the initial report, a table of quantities of chemical elements, or water, and of inert soil particles lost by the ecosystem to its surroundings, or gained as the case may be. Exchanges with the atmosphere, with the subsoil (below the lowest horizon for which state variables are included), and laterally along the soil surface, are distinguished These figures are accumulated over the period of simulation. Precipitation figures are also accumulated and included in the reports. The depth of snow lying on the soil surface is reported in mm., and its weight in $g.ha^{-1}$.

Array Dimensions

Limitations imposed by dimensions for arrays used in the REPORT subroutine, though not in the calling program, are as follows.

DRYM (a)	SDRYM (d)
DRYMV (b)	SOURCE (b,f)
DRYTH (c)	AGAINT (e)

a: Number of plant organs, or number of animal cohorts, whichever is larger.

b: Number of plant organs, or number of animal species, whichever is larger.

c: Number of plant species.

d: Number of plant organs.

e: Number of chemical elements.

f: Number of channels for gain or loss to the system.

SUBROUTINE GRAF

Graphical output is available on the line printer, in the form of either line graphs or block graphs, in each case occupying a single printer page. Line graphs use continuous strings of the symbols A, B, ... H, to represent the time course, through the simulation, of up to eight different variables. All are plotted on the same scale, which is normally adjusted so that the extreme values attained can just fit into the page. In the block graphs, the time course of a single variable only is plotted. Each type of graph is provided with appropriate titling.

The X-axis of the graph is always the time in days. The Y-axis is scaled so that all values graphed are within the range $-10 < Y < +10$, and an integral power of 10 is specified in the title as the scaling factor. If the values extend outside the limits $\pm\ 10^{10}$, an error message results. If all values of Y are identical, a small range of Y values around this point is graphed. By use of the ORIGIN option in the main program, a zero value of Y may be specified as the upper or lower limit, in place of the maximum or minimum value actually occurring in the simulation.

The graphs are printed after the final tabulated report. Graphing facilities are provided for all state variables; for all their totals; and for all accumulated exchanges between the ecosystem and its surroundings.

TIME AND SPACE REQUIREMENTS

On the UNIVAC 1108, the time required for compilation, and the number of words (36-bit) of core storage required for coded instructions and for data by the programs as listed, are tabulated below:

PROGRAM	COMPILATION TIME (secs)	CODE STORAGE	DATA STORAGE
MAIN	8.01	3158	3597
EXOGEN	2.63	944	2870
REPORT	4.84	4305	468
GRAF	1.18	512	3801
COMMON STORAGE			16489
TOTAL	16.66	8919	27225

Facilities are provided for monitoring the C.P.U. time required during execution for different parts of the simulation. For this purpose, use is made of the system subroutine EXTIME, which would need to be replaced if the programs were implemented on any other system.

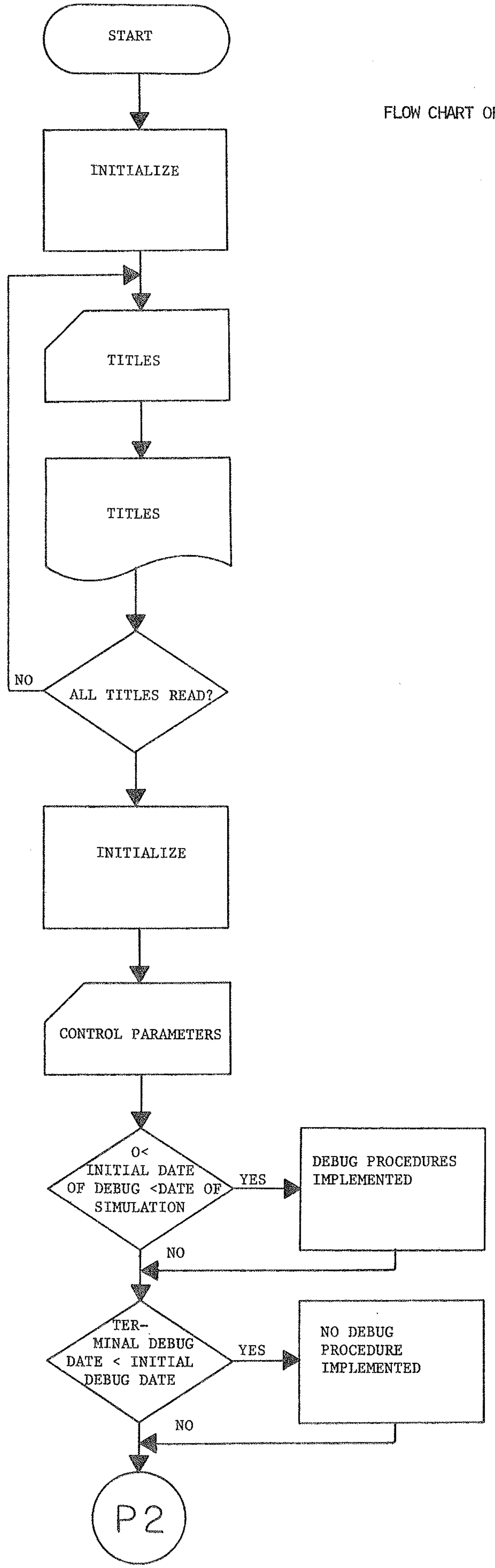
In a trial run with 253 state variables, and the program as listed, the C.P.U. time (in secs) required for the various parts of the execution were as follows:

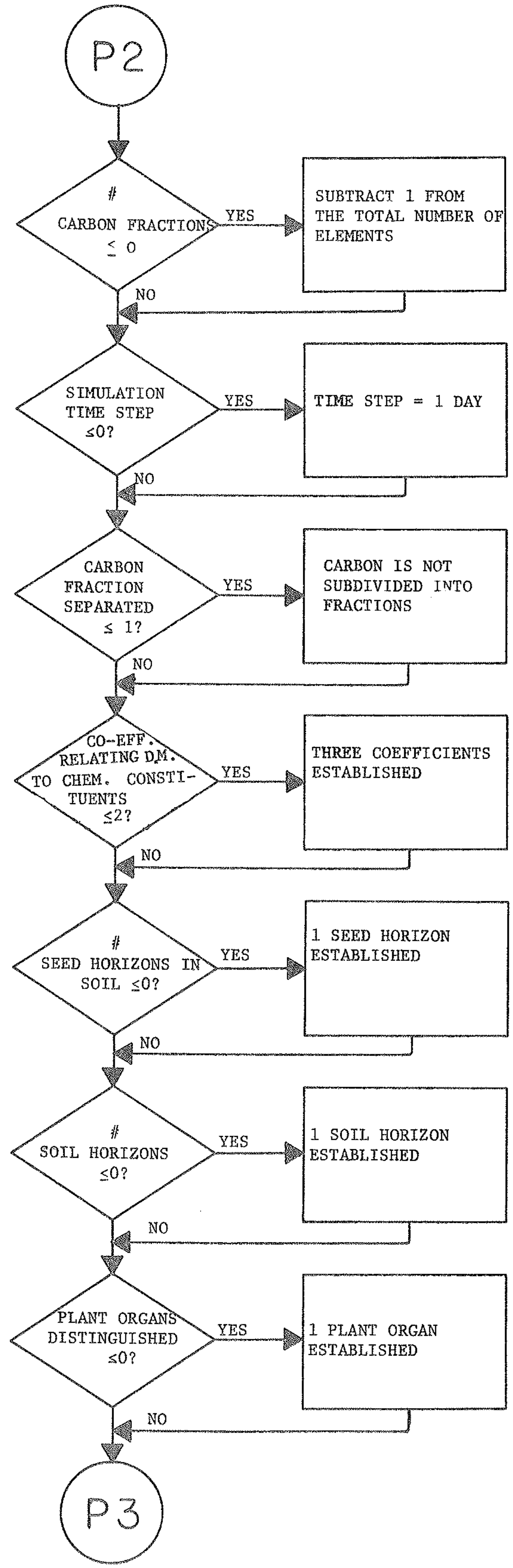
Initialization and input	0.39 †
Simulation, per time unit	0.04 *
Tabulated report	0.64 †
Graph	0.45

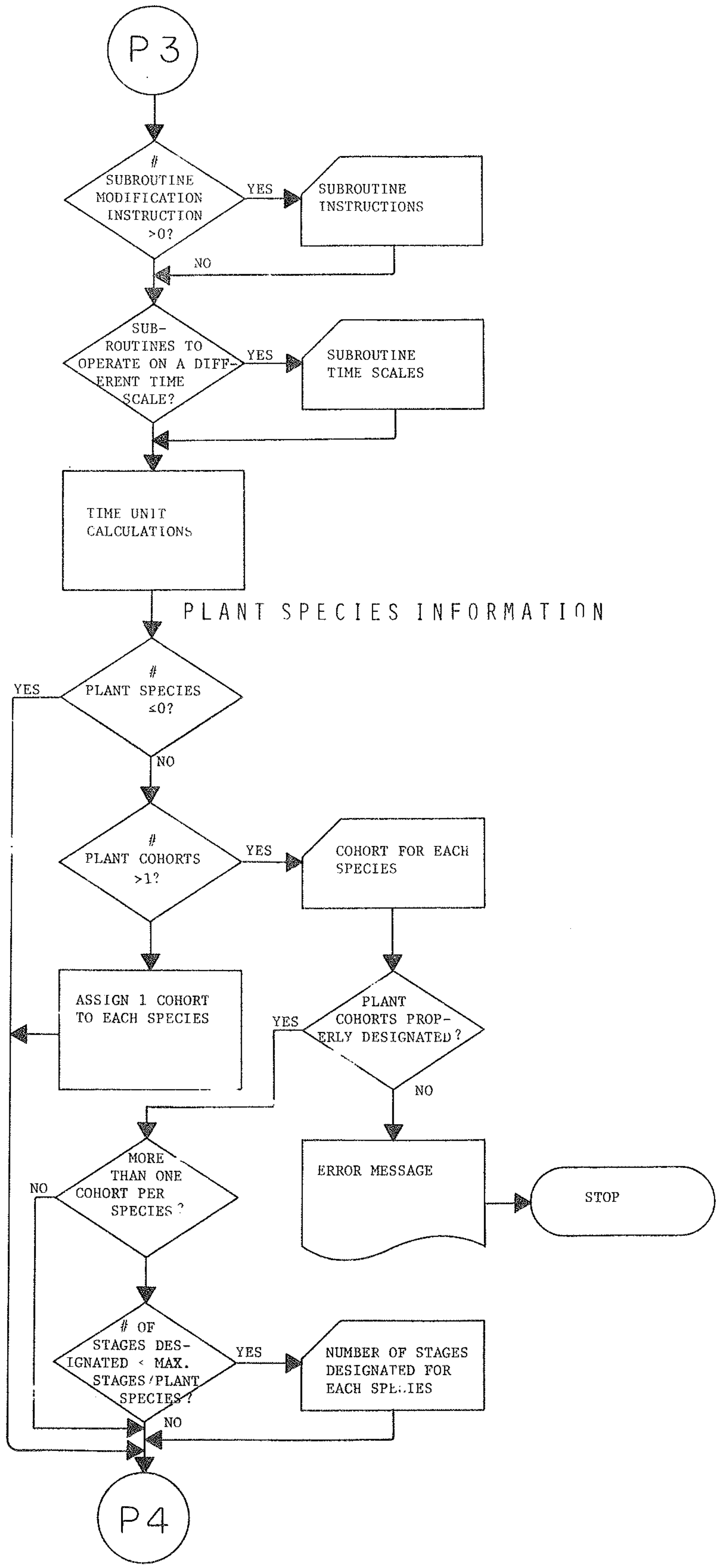
(*) This is the time required by operations within the main program and the subroutine EXOGEN; the time required by the process subroutines is additional, and is indicated in the descriptions of these subroutines. This time depends on the size of the COMMON blocks / STATE / , / DECINC / and / TOTALS /, and of the array areas within them that are in use.

(†) These times largely depend on the size of the array areas in use.

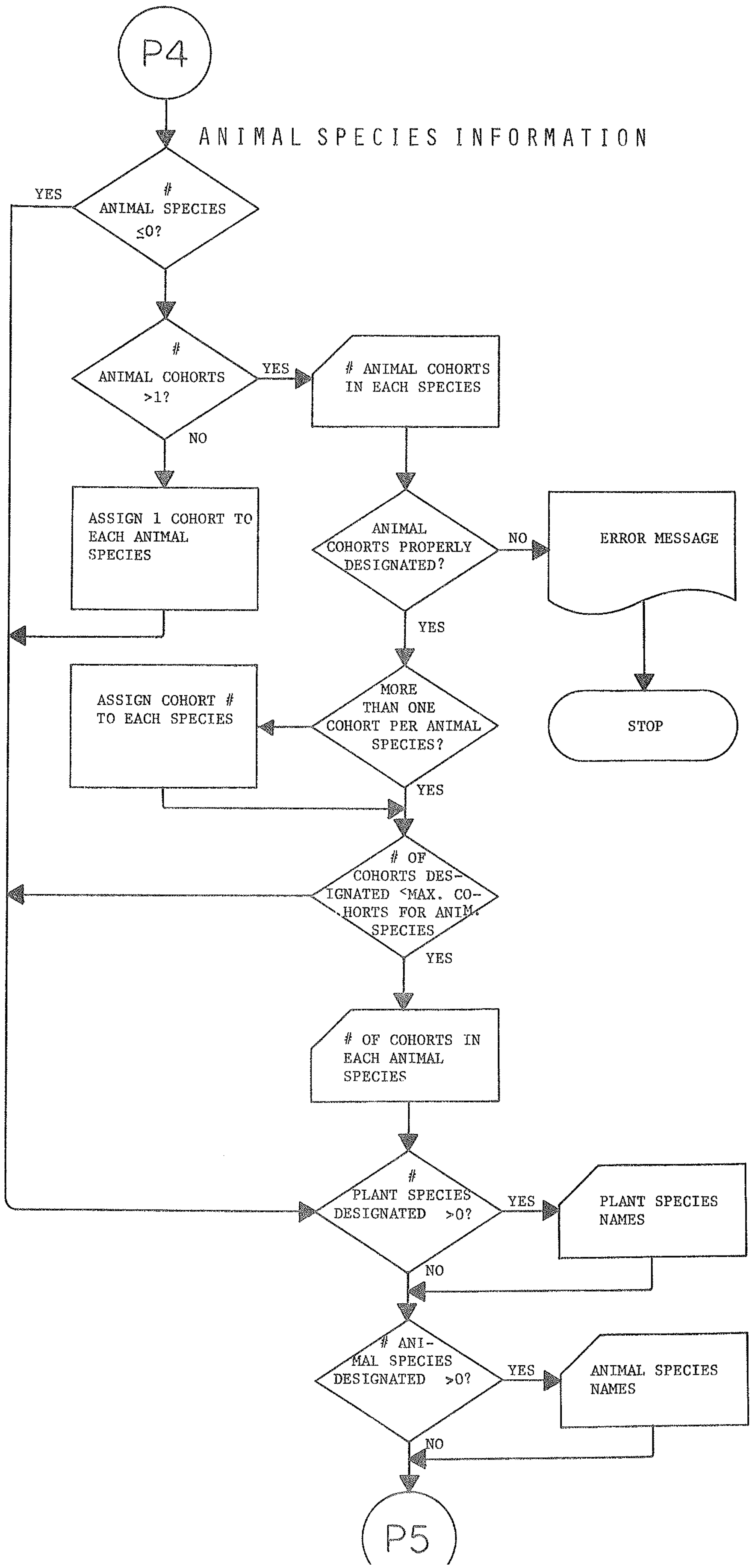
FLOW CHART OF MAIN



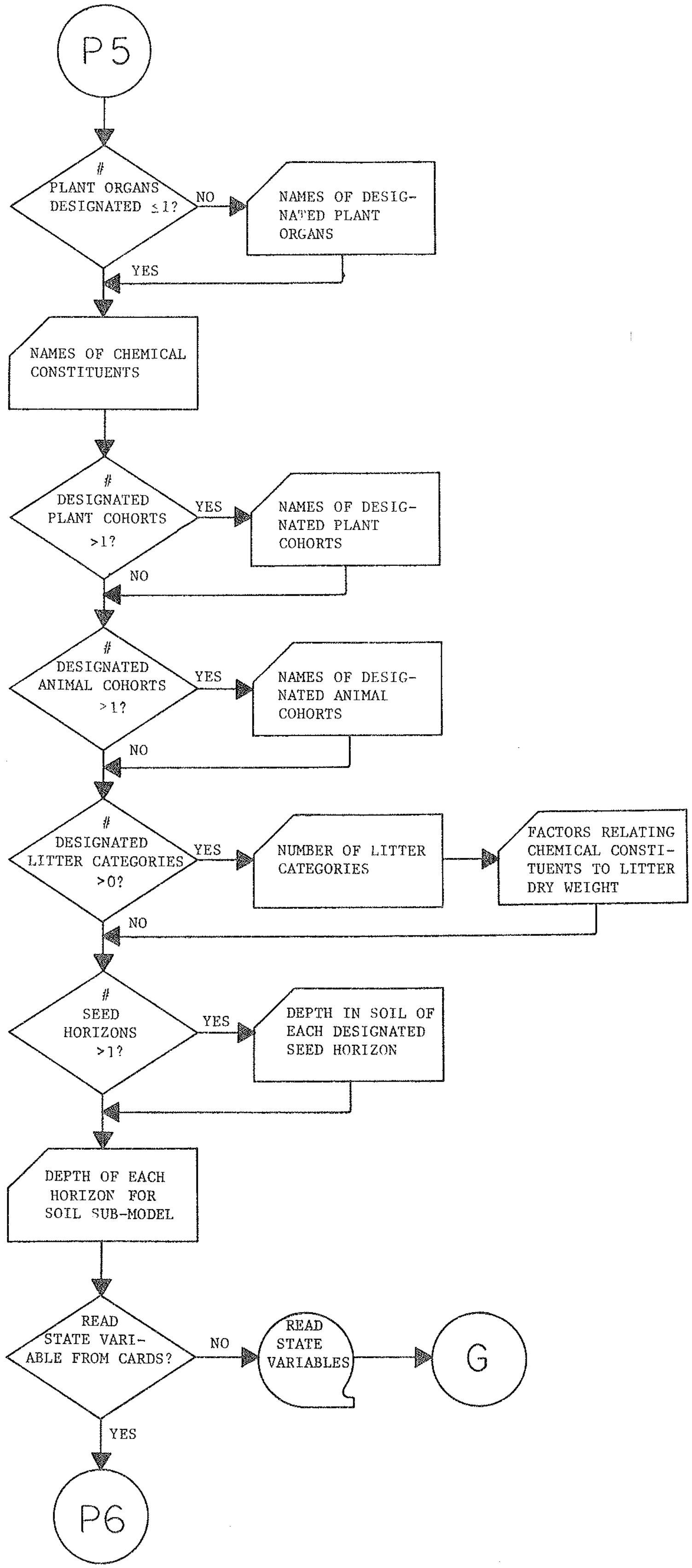

P2
#
CARBON FRACTIONS
≤ 0
YES
SUBTRACT 1 FROM THE TOTAL NUMBER OF ELEMENTS
NO
SIMULATION TIME STEP ≤0?
YES
TIME STEP = 1 DAY
NO
CARBON FRACTION SEPARATED ≤ 1?
YES
CARBON IS NOT SUBDIVIDED INTO FRACTIONS
NO
CO-EFF. RELATING D.M. TO CHEM. CONSTI-TUENTS ≤2?
YES
THREE COEFFICIENTS ESTABLISHED
NO
#
SEED HORIZONS IN SOIL ≤0?
YES
1 SEED HORIZON ESTABLISHED
NO
#
SOIL HORIZONS ≤0?
YES
1 SOIL HORIZON ESTABLISHED
NO
PLANT ORGANS DISTINGUISHED ≤0?
YES
1 PLANT ORGAN ESTABLISHED
NO
P3

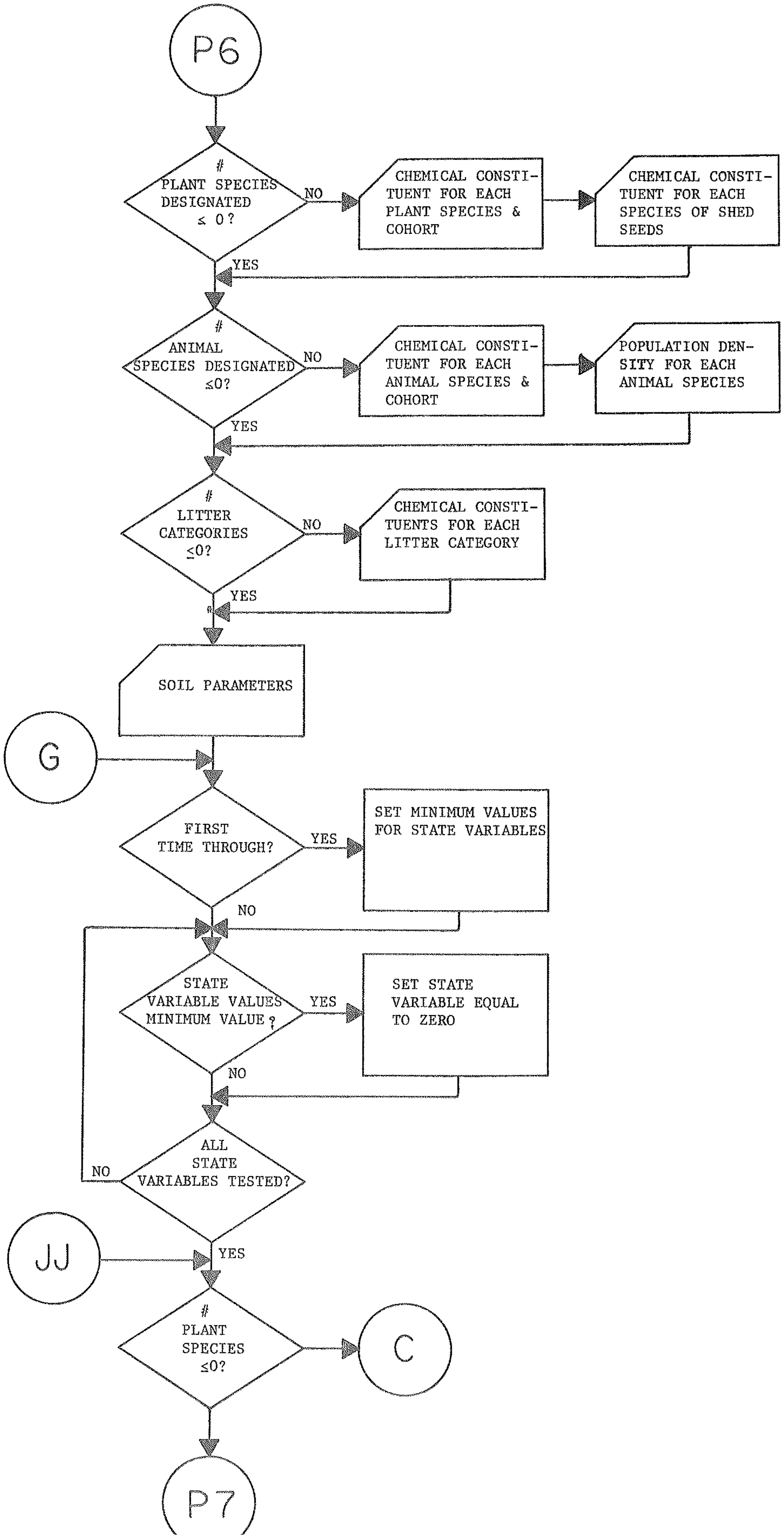

P3
SUBROUTINE MODIFICATION INSTRUCTION >0?
YES
SUBROUTINE INSTRUCTIONS
NO
SUB-ROUTINES TO OPERATE ON A DIFF-ERENT TIME SCALE?
YES
SUBROUTINE TIME SCALES
TIME UNIT CALCULATIONS
PLANT SPECIES INFORMATION
PLANT SPECIES ≤0?
YES
NO
PLANT COHORTS >1?
YES
COHORT FOR EACH SPECIES
ASSIGN 1 COHORT TO EACH SPECIES
PLANT COHORTS PROP-ERLY DESIGNATED?
YES
NO
ERROR MESSAGE
STOP
MORE THAN ONE COHORT PER SPECIES?
NO
OF STAGES DES-IGNATED < MAX. STAGES/PLANT SPECIES?
YES
NUMBER OF STAGES DESIGNATED FOR EACH SPECIES
NO
P4

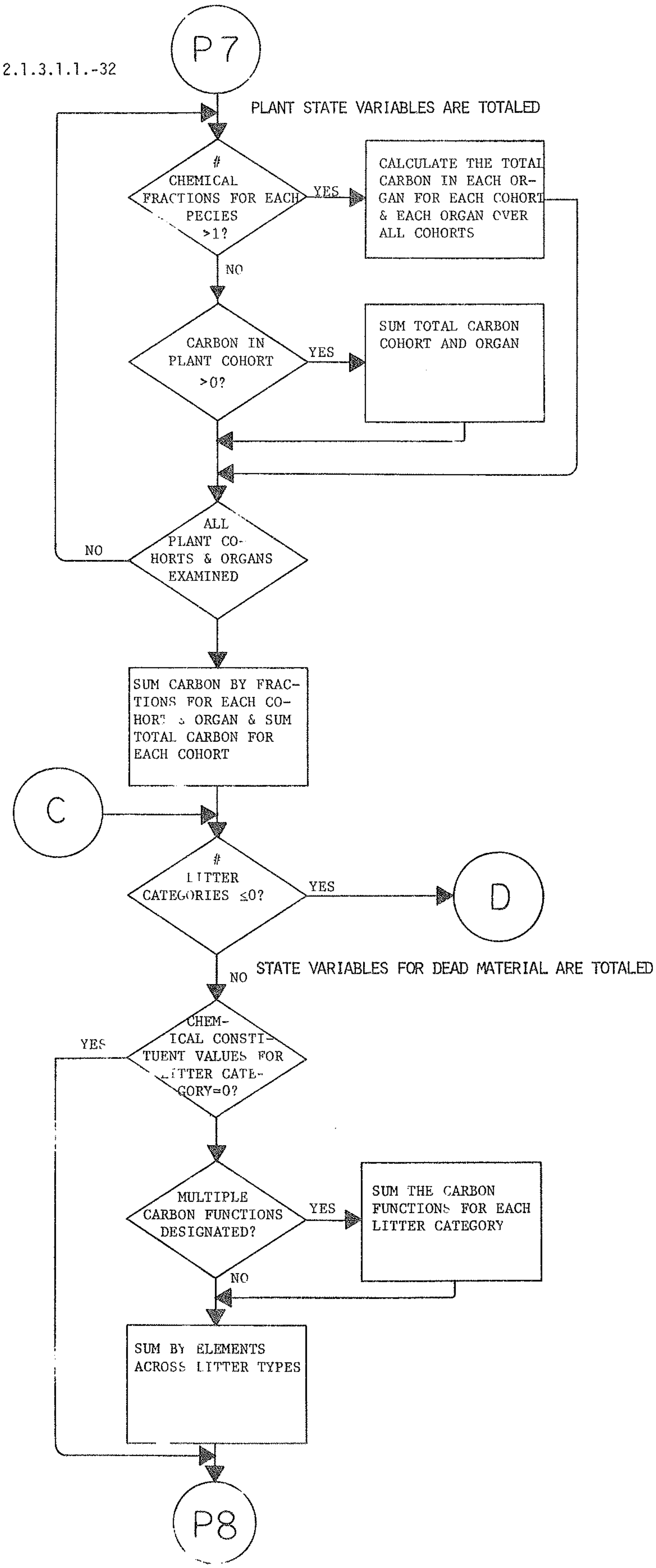
ANIMAL SPECIES INFORMATION

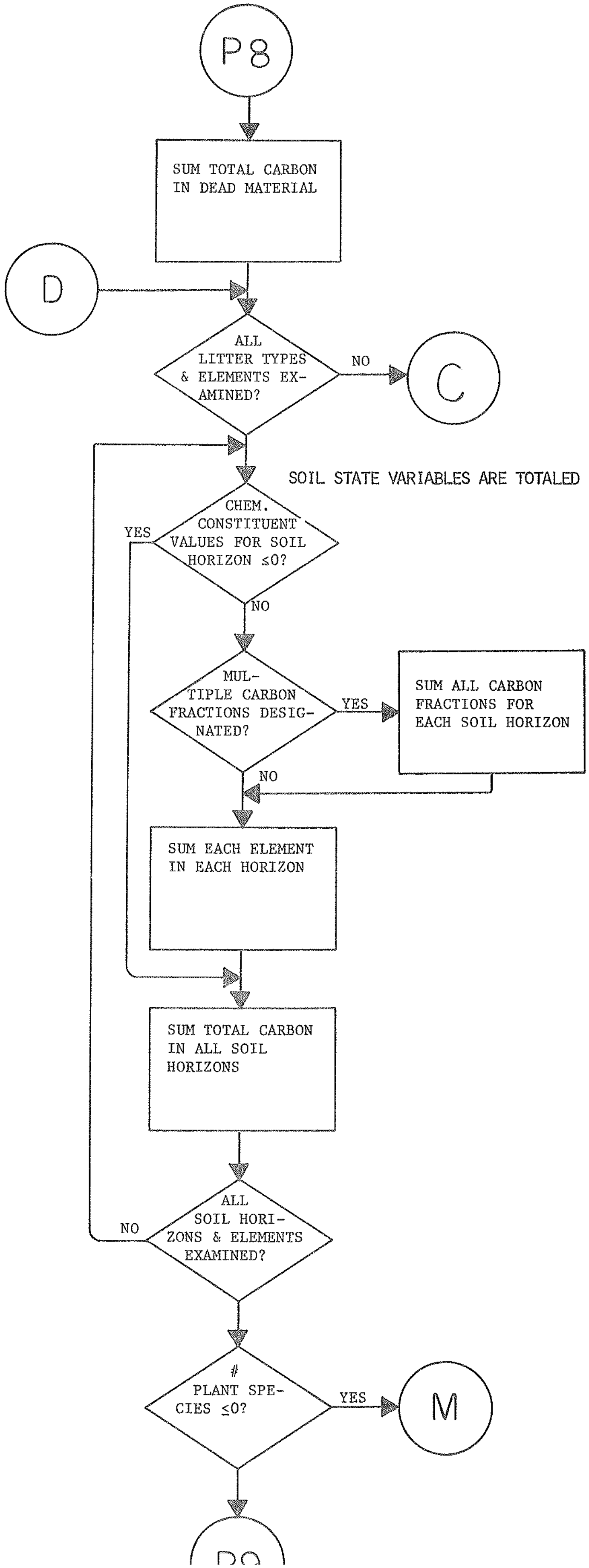


2.1.3.1.1.-30

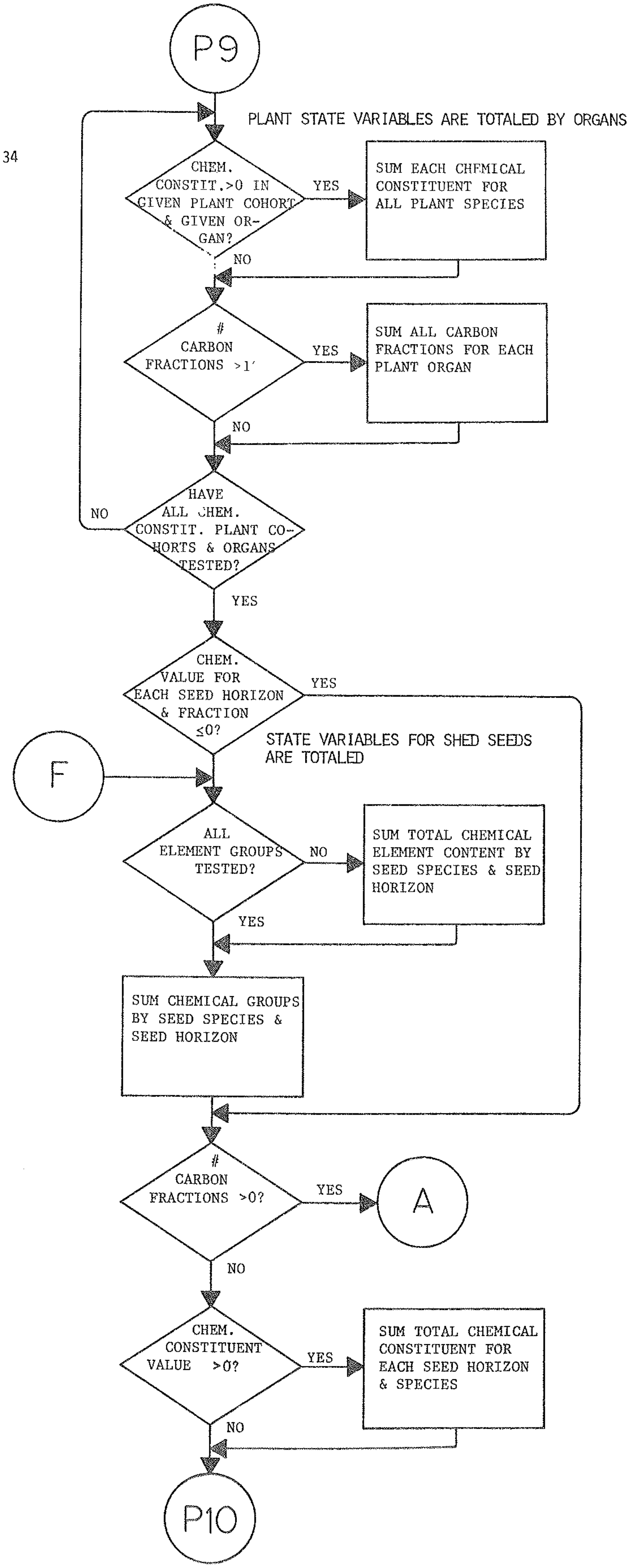

P5
#
PLANT ORGANS
DESIGNATED ≤1?
NO
NAMES OF DESIG-
NATED PLANT
ORGANS
YES
NAMES OF CHEMICAL
CONSTITUENTS
#
DESIGNATED
PLANT COHORTS
>1?
YES
NAMES OF DESIG-
NATED PLANT
COHORTS
NO
#
DESIGNATED
ANIMAL COHORTS
>1?
YES
NAMES OF DESIG-
NATED ANIMAL
COHORTS
NO
#
DESIGNATED
LITTER CATEGORIES
>0?
YES
NUMBER OF LITTER
CATEGORIES
FACTORS RELATING
CHEMICAL CONSTI-
TUENTS TO LITTER
DRY WEIGHT
NO
#
SEED
HORIZONS
>1?
YES
DEPTH IN SOIL OF
EACH DESIGNATED
SEED HORIZON
DEPTH OF EACH
HORIZON FOR
SOIL SUB-MODEL
READ
STATE VARI-
ABLE FROM CARDS?
NO
READ
STATE
VARIABLES
G
YES
P6


P6
PLANT SPECIES DESIGNATED ≤ 0 ?
NO
CHEMICAL CONSTITUENT FOR EACH PLANT SPECIES & COHORT
CHEMICAL CONSTITUENT FOR EACH SPECIES OF SHED SEEDS
YES
ANIMAL SPECIES DESIGNATED ≤0?
NO
CHEMICAL CONSTITUENT FOR EACH ANIMAL SPECIES & COHORT
POPULATION DENSITY FOR EACH ANIMAL SPECIES
YES
LITTER CATEGORIES ≤0?
NO
CHEMICAL CONSTITUENTS FOR EACH LITTER CATEGORY
YES
SOIL PARAMETERS
G
FIRST TIME THROUGH?
YES
SET MINIMUM VALUES FOR STATE VARIABLES
NO
STATE VARIABLE VALUES MINIMUM VALUE ?
YES
SET STATE VARIABLE EQUAL TO ZERO
NO
ALL STATE VARIABLES TESTED?
NO
YES
JJ
PLANT SPECIES ≤0?
C
P7

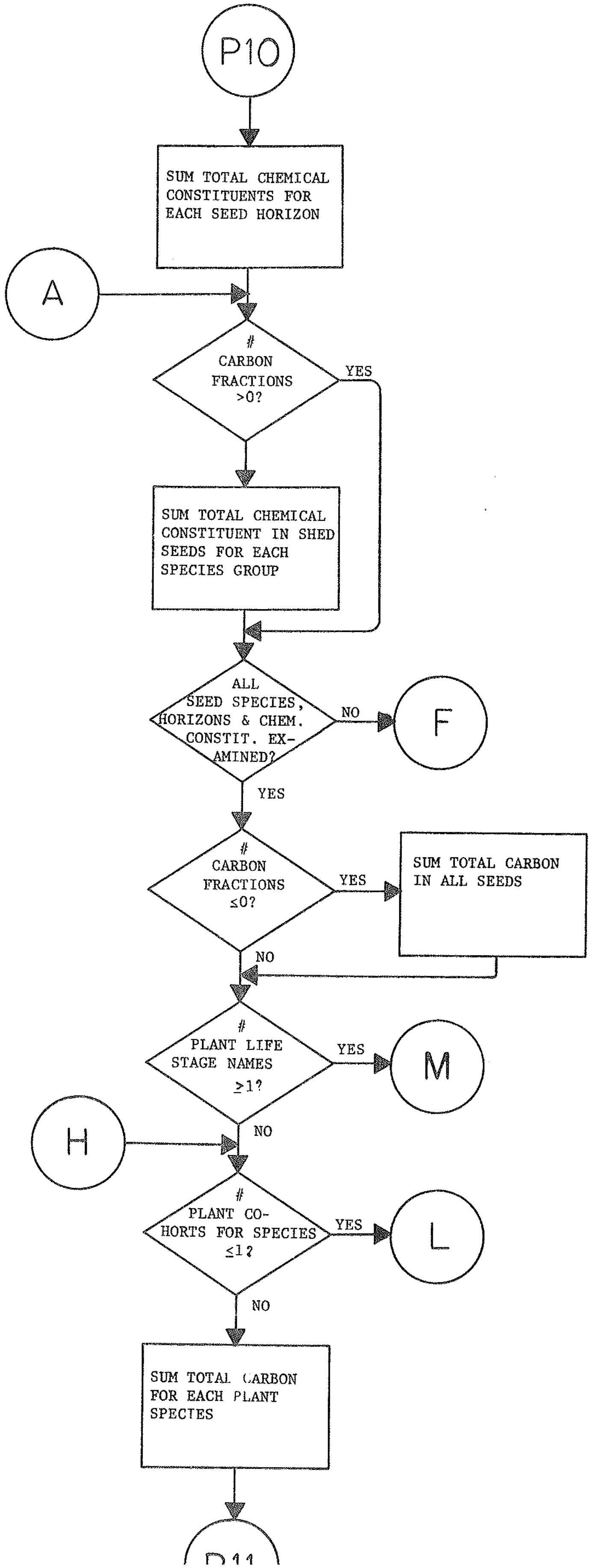

P7
PLANT STATE VARIABLES ARE TOTALED
CHEMICAL FRACTIONS FOR EACH PECIES >1?
YES
CALCULATE THE TOTAL CARBON IN EACH ORGAN FOR EACH COHORT & EACH ORGAN OVER ALL COHORTS
NO
CARBON IN PLANT COHORT >0?
YES
SUM TOTAL CARBON COHORT AND ORGAN
ALL PLANT COHORTS & ORGANS EXAMINED
NO
SUM CARBON BY FRACTIONS FOR EACH COHORT & ORGAN & SUM TOTAL CARBON FOR EACH COHORT
C
LITTER CATEGORIES ≤0?
YES
D
NO
STATE VARIABLES FOR DEAD MATERIAL ARE TOTALED
CHEMICAL CONSTITUENT VALUES FOR LITTER CATEGORY=0?
YES
MULTIPLE CARBON FUNCTIONS DESIGNATED?
YES
SUM THE CARBON FUNCTIONS FOR EACH LITTER CATEGORY
NO
SUM BY ELEMENTS ACROSS LITTER TYPES
P8


P8
SUM TOTAL CARBON IN DEAD MATERIAL
D
ALL LITTER TYPES & ELEMENTS EXAMINED?
NO
C
SOIL STATE VARIABLES ARE TOTALED
CHEM. CONSTITUENT VALUES FOR SOIL HORIZON ≤0?
YES
NO
MULTIPLE CARBON FRACTIONS DESIGNATED?
YES
SUM ALL CARBON FRACTIONS FOR EACH SOIL HORIZON
NO
SUM EACH ELEMENT IN EACH HORIZON
SUM TOTAL CARBON IN ALL SOIL HORIZONS
ALL SOIL HORIZONS & ELEMENTS EXAMINED?
NO
PLANT SPECIES ≤0?
YES
M

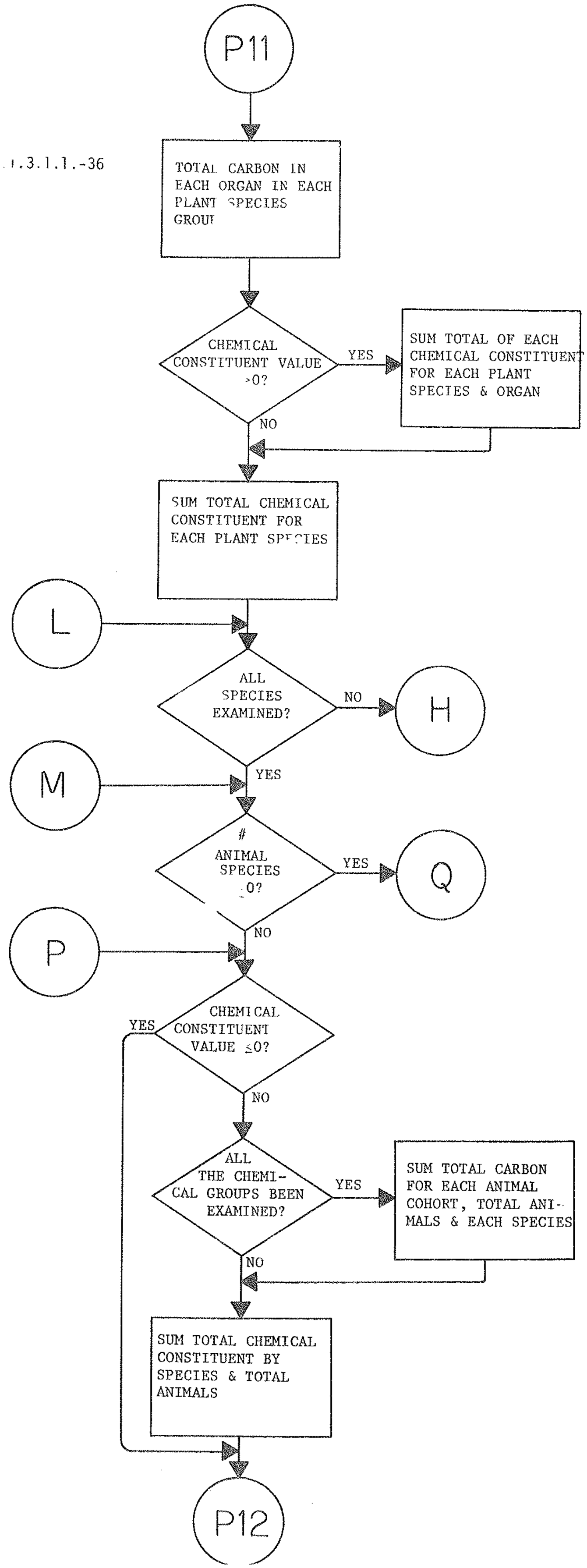
2.1.3 1.1.-34

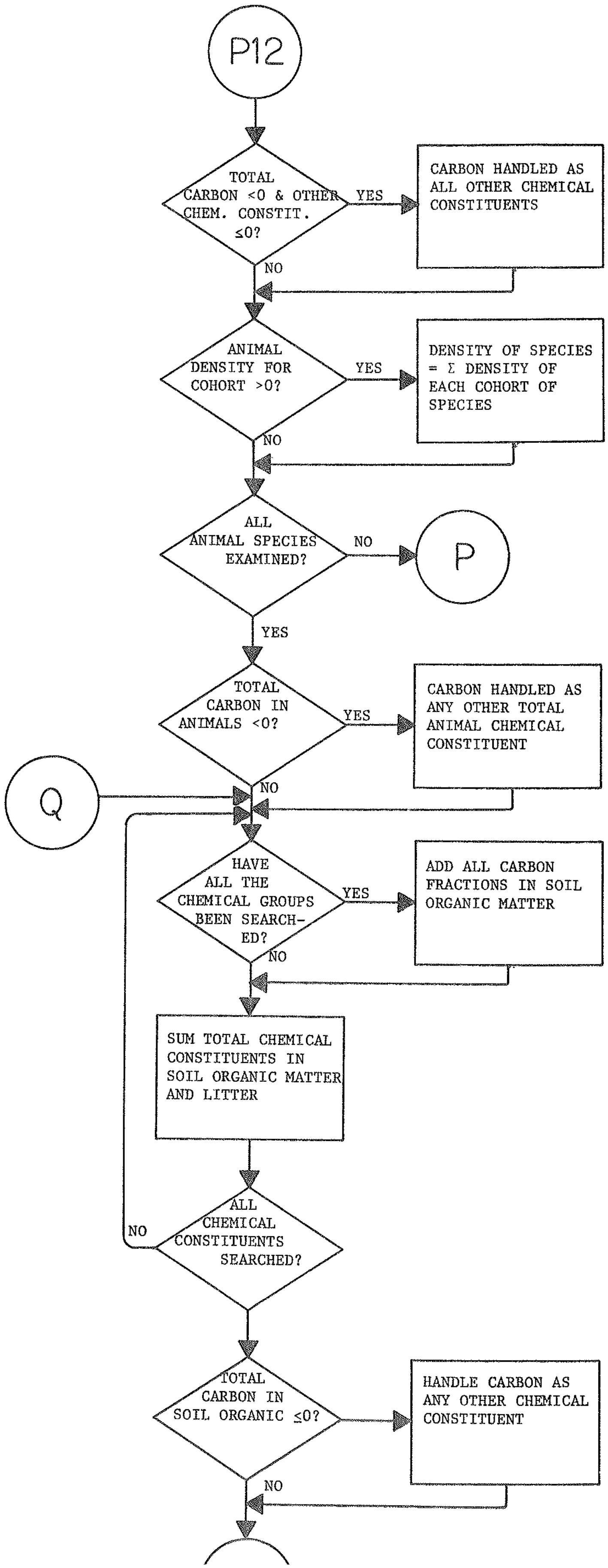


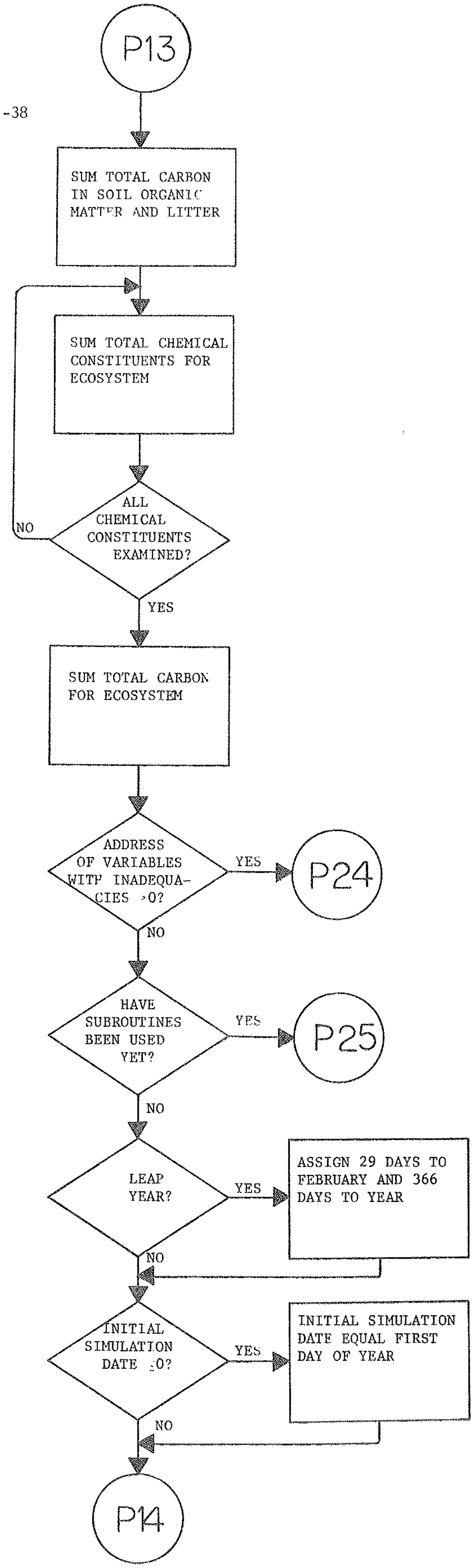
P9
PLANT STATE VARIABLES ARE TOTALED BY ORGANS
CHEM. CONSTIT.>0 IN GIVEN PLANT COHORT & GIVEN ORGAN?
YES
SUM EACH CHEMICAL CONSTITUENT FOR ALL PLANT SPECIES
NO
CARBON FRACTIONS >1?
YES
SUM ALL CARBON FRACTIONS FOR EACH PLANT ORGAN
NO
HAVE ALL CHEM. CONSTIT. PLANT COHORTS & ORGANS TESTED?
NO
YES
CHEM. VALUE FOR EACH SEED HORIZON & FRACTION ≤0?
YES
STATE VARIABLES FOR SHED SEEDS ARE TOTALED
F
ALL ELEMENT GROUPS TESTED?
NO
SUM TOTAL CHEMICAL ELEMENT CONTENT BY SEED SPECIES & SEED HORIZON
YES
SUM CHEMICAL GROUPS BY SEED SPECIES & SEED HORIZON
CARBON FRACTIONS >0?
YES
A
NO
CHEM. CONSTITUENT VALUE >0?
YES
SUM TOTAL CHEMICAL CONSTITUENT FOR EACH SEED HORIZON & SPECIES
NO
P10

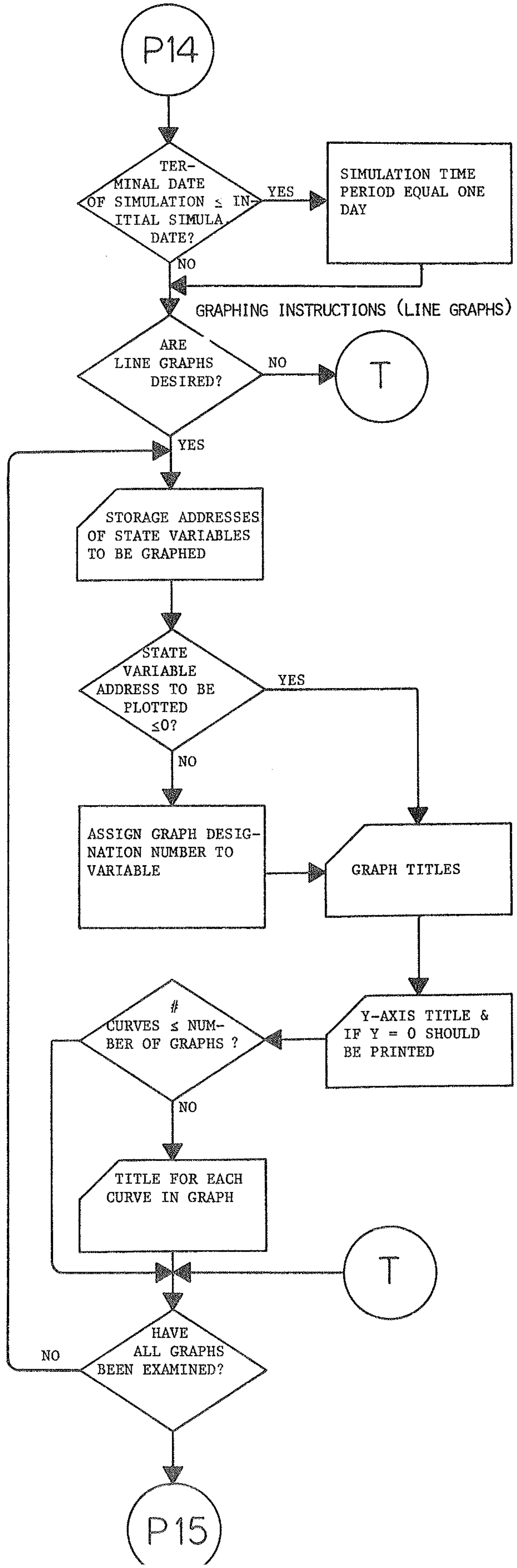

P10
SUM TOTAL CHEMICAL CONSTITUENTS FOR EACH SEED HORIZON
A
CARBON FRACTIONS >0?
YES
SUM TOTAL CHEMICAL CONSTITUENT IN SHED SEEDS FOR EACH SPECIES GROUP
ALL SEED SPECIES, HORIZONS & CHEM. CONSTIT. EXAMINED?
NO
F
YES
CARBON FRACTIONS ≤0?
YES
SUM TOTAL CARBON IN ALL SEEDS
NO
PLANT LIFE STAGE NAMES ≥1?
YES
M
NO
H
PLANT COHORTS FOR SPECIES ≤1?
YES
L
NO
SUM TOTAL CARBON FOR EACH PLANT SPECIES

2.1.3.1.1.-36

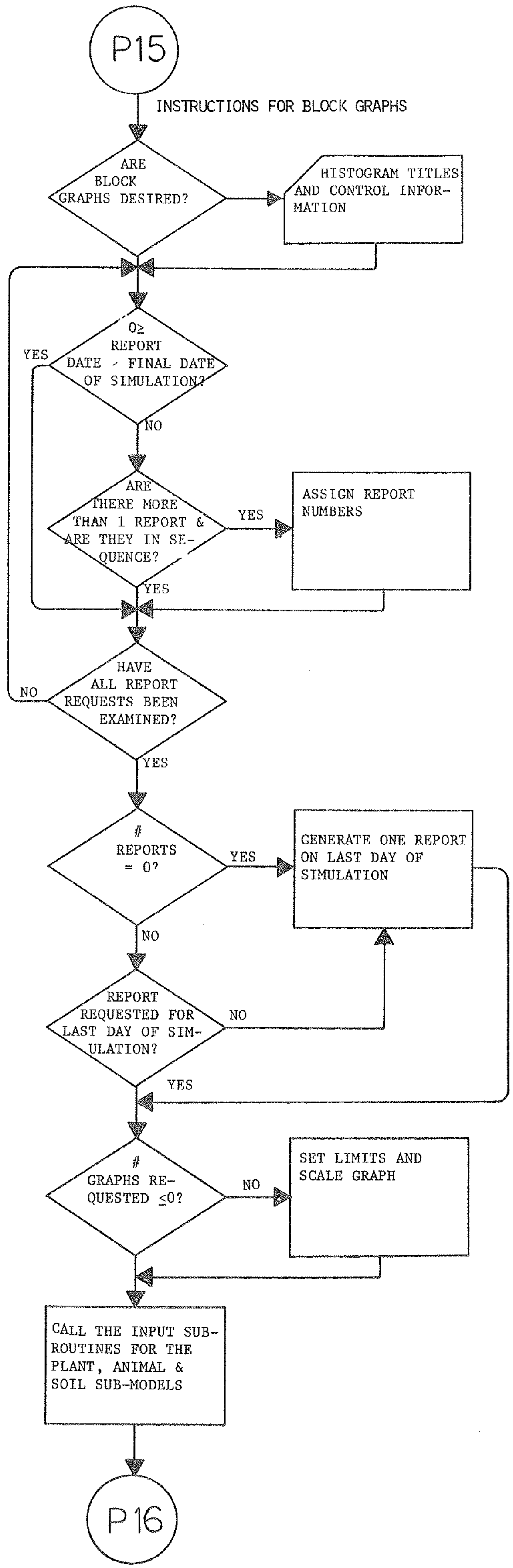

P11
TOTAL CARBON IN EACH ORGAN IN EACH PLANT SPECIES GROUP
CHEMICAL CONSTITUENT VALUE >0?
YES
SUM TOTAL OF EACH CHEMICAL CONSTITUENT FOR EACH PLANT SPECIES & ORGAN
NO
SUM TOTAL CHEMICAL CONSTITUENT FOR EACH PLANT SPECIES
L
ALL SPECIES EXAMINED?
NO
H
YES
M
ANIMAL SPECIES ≤0?
YES
Q
NO
P
CHEMICAL CONSTITUENT VALUE ≤0?
YES
NO
ALL THE CHEMI-CAL GROUPS BEEN EXAMINED?
YES
SUM TOTAL CARBON FOR EACH ANIMAL COHORT, TOTAL ANI-MALS & EACH SPECIES
NO
SUM TOTAL CHEMICAL CONSTITUENT BY SPECIES & TOTAL ANIMALS
P12


P12
TOTAL CARBON <0 & OTHER CHEM. CONSTIT. ≤0?
YES
CARBON HANDLED AS ALL OTHER CHEMICAL CONSTITUENTS
NO
ANIMAL DENSITY FOR COHORT >0?
YES
DENSITY OF SPECIES = Σ DENSITY OF EACH COHORT OF SPECIES
NO
ALL ANIMAL SPECIES EXAMINED?
NO
P
YES
TOTAL CARBON IN ANIMALS <0?
YES
CARBON HANDLED AS ANY OTHER TOTAL ANIMAL CHEMICAL CONSTITUENT
NO
Q
HAVE ALL THE CHEMICAL GROUPS BEEN SEARCH-ED?
YES
ADD ALL CARBON FRACTIONS IN SOIL ORGANIC MATTER
NO
SUM TOTAL CHEMICAL CONSTITUENTS IN SOIL ORGANIC MATTER AND LITTER
ALL CHEMICAL CONSTITUENTS SEARCHED?
NO
TOTAL CARBON IN SOIL ORGANIC ≤0?
HANDLE CARBON AS ANY OTHER CHEMICAL CONSTITUENT
NO

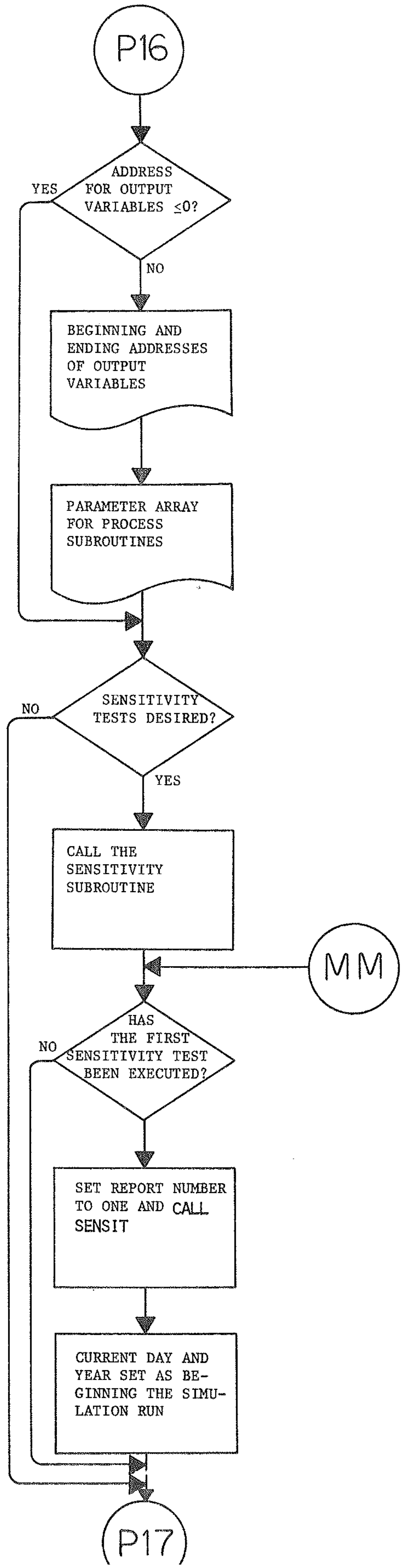

P13
SUM TOTAL CARBON IN SOIL ORGANIC MATTER AND LITTER
SUM TOTAL CHEMICAL CONSTITUENTS FOR ECOSYSTEM
ALL CHEMICAL CONSTITUENTS EXAMINED?
NO
YES
SUM TOTAL CARBON FOR ECOSYSTEM
ADDRESS OF VARIABLES WITH INADEQUACIES >0?
YES
P24
NO
HAVE SUBROUTINES BEEN USED YET?
YES
P25
NO
LEAP YEAR?
YES
ASSIGN 29 DAYS TO FEBRUARY AND 366 DAYS TO YEAR
NO
INITIAL SIMULATION DATE ≤0?
YES
INITIAL SIMULATION DATE EQUAL FIRST DAY OF YEAR
NO
P14


P14
TERMINAL DATE OF SIMULATION ≤ INITIAL SIMULA. DATE?
YES
SIMULATION TIME PERIOD EQUAL ONE DAY
NO
GRAPHING INSTRUCTIONS (LINE GRAPHS)
ARE LINE GRAPHS DESIRED?
NO
T
YES
STORAGE ADDRESSES OF STATE VARIABLES TO BE GRAPHED
STATE VARIABLE ADDRESS TO BE PLOTTED ≤0?
YES
NO
ASSIGN GRAPH DESIGNATION NUMBER TO VARIABLE
GRAPH TITLES
Y-AXIS TITLE & IF Y = 0 SHOULD BE PRINTED
CURVES ≤ NUMBER OF GRAPHS ?
NO
TITLE FOR EACH CURVE IN GRAPH
T
HAVE ALL GRAPHS BEEN EXAMINED?
NO
P15

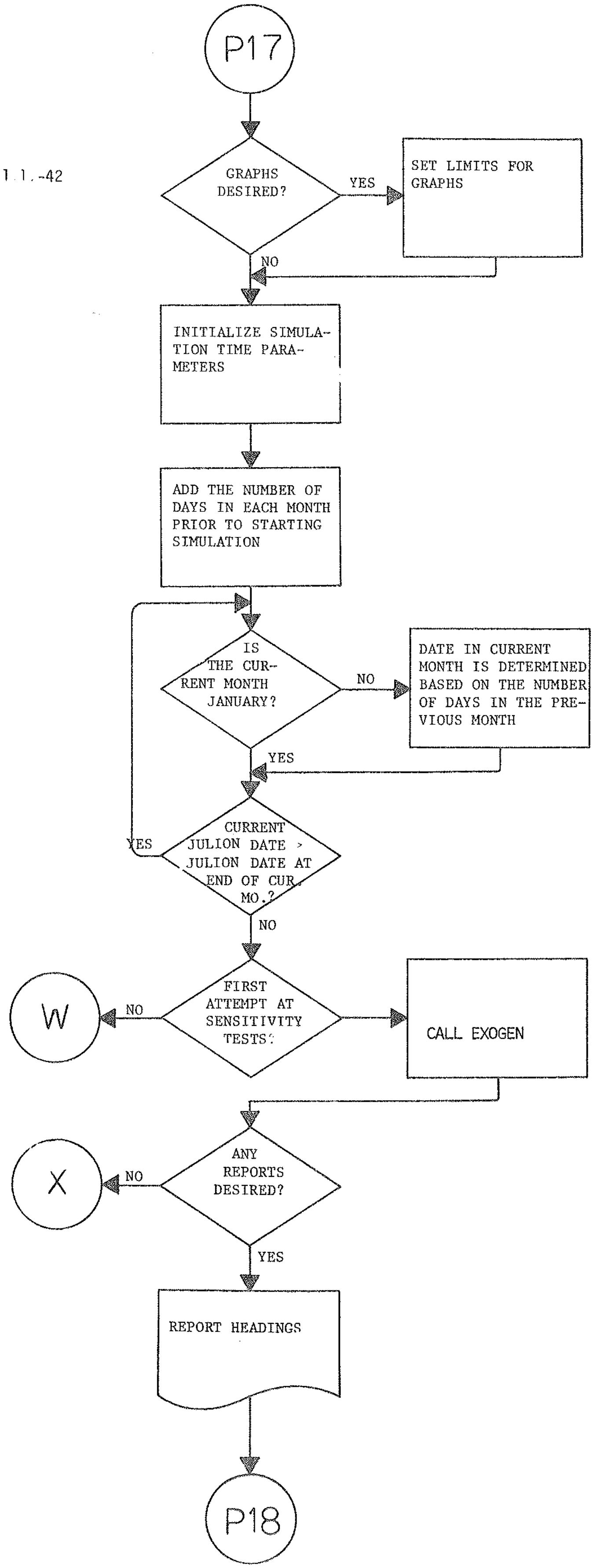
2.1.3.1.1 -40

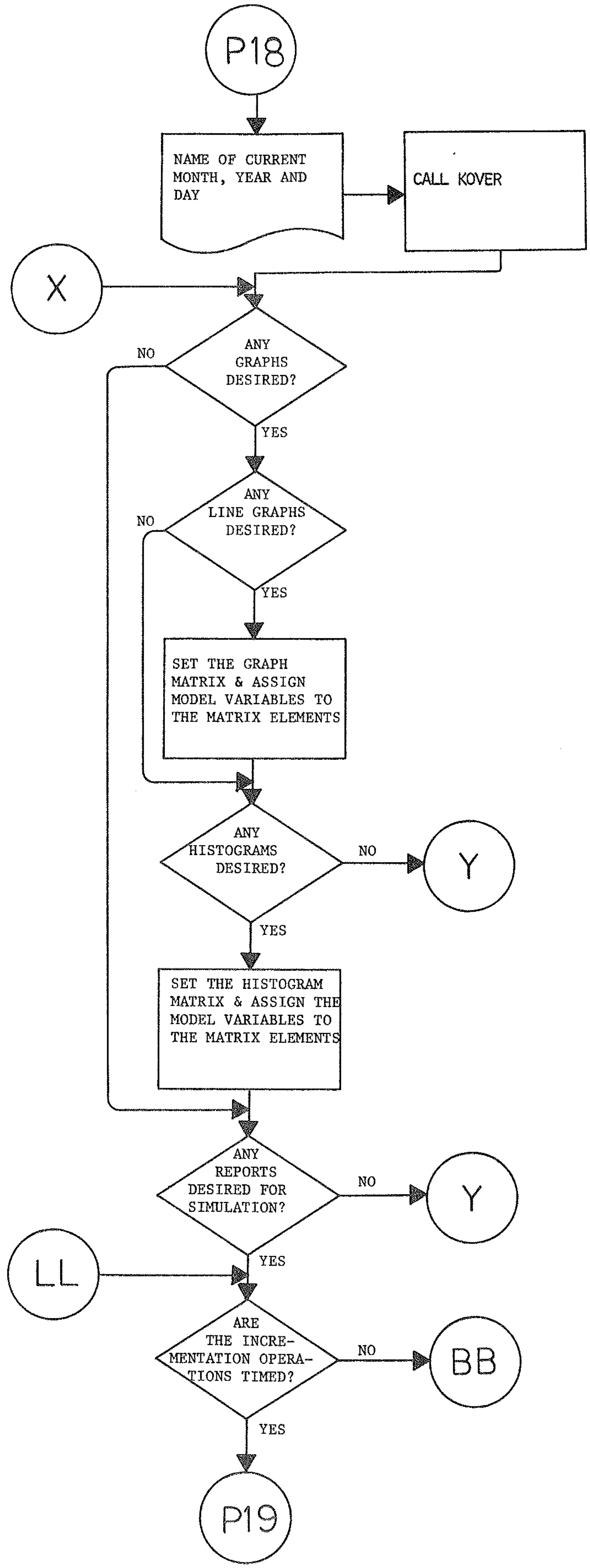


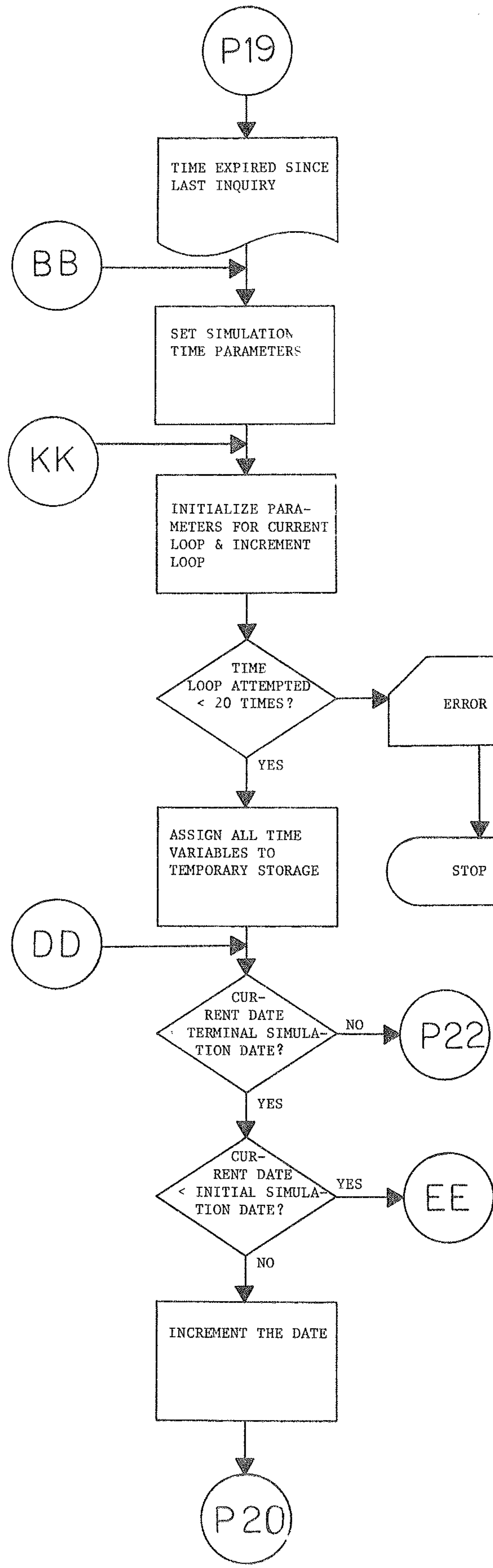
P15
INSTRUCTIONS FOR BLOCK GRAPHS
ARE BLOCK GRAPHS DESIRED?
HISTOGRAM TITLES AND CONTROL INFORMATION
0≥ REPORT DATE - FINAL DATE OF SIMULATION?
YES
NO
ARE THERE MORE THAN 1 REPORT & ARE THEY IN SEQUENCE?
YES
ASSIGN REPORT NUMBERS
YES
HAVE ALL REPORT REQUESTS BEEN EXAMINED?
NO
YES
REPORTS = 0?
YES
GENERATE ONE REPORT ON LAST DAY OF SIMULATION
NO
REPORT REQUESTED FOR LAST DAY OF SIMULATION?
NO
YES
GRAPHS REQUESTED ≤0?
NO
SET LIMITS AND SCALE GRAPH
CALL THE INPUT SUBROUTINES FOR THE PLANT, ANIMAL & SOIL SUB-MODELS
P16

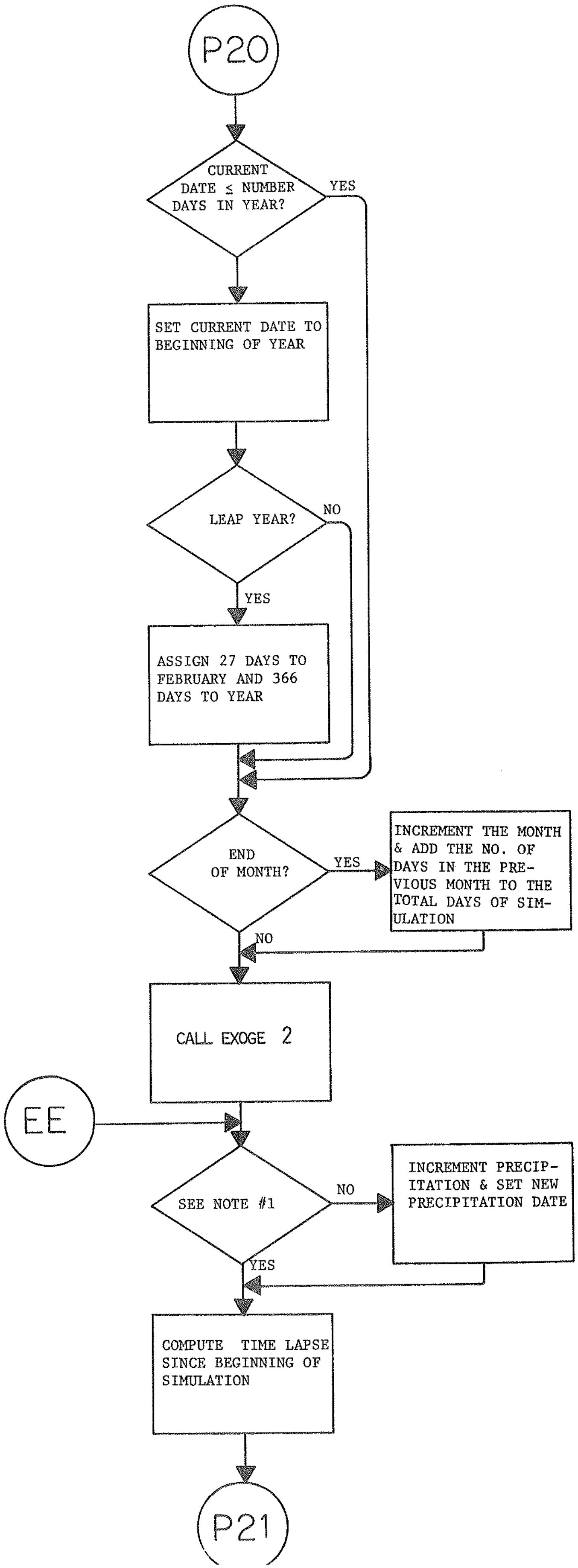

P16
ADDRESS FOR OUTPUT VARIABLES ≤0?
YES
NO
BEGINNING AND ENDING ADDRESSES OF OUTPUT VARIABLES
PARAMETER ARRAY FOR PROCESS SUBROUTINES
SENSITIVITY TESTS DESIRED?
NO
YES
CALL THE SENSITIVITY SUBROUTINE
MM
HAS THE FIRST SENSITIVITY TEST BEEN EXECUTED?
NO
SET REPORT NUMBER TO ONE AND CALL SENSIT
CURRENT DAY AND YEAR SET AS BE-GINNING THE SIMU-LATION RUN
P17

2.1.3.1.1.-42


P17
GRAPHS DESIRED?
YES
SET LIMITS FOR GRAPHS
NO
INITIALIZE SIMULATION TIME PARAMETERS
ADD THE NUMBER OF DAYS IN EACH MONTH PRIOR TO STARTING SIMULATION
IS THE CURRENT MONTH JANUARY?
NO
DATE IN CURRENT MONTH IS DETERMINED BASED ON THE NUMBER OF DAYS IN THE PREVIOUS MONTH
YES
CURRENT JULION DATE > JULION DATE AT END OF CUR. MO.?
YES
NO
FIRST ATTEMPT AT SENSITIVITY TESTS?
NO
W
CALL EXOGEN
ANY REPORTS DESIRED?
NO
X
YES
REPORT HEADINGS
P18

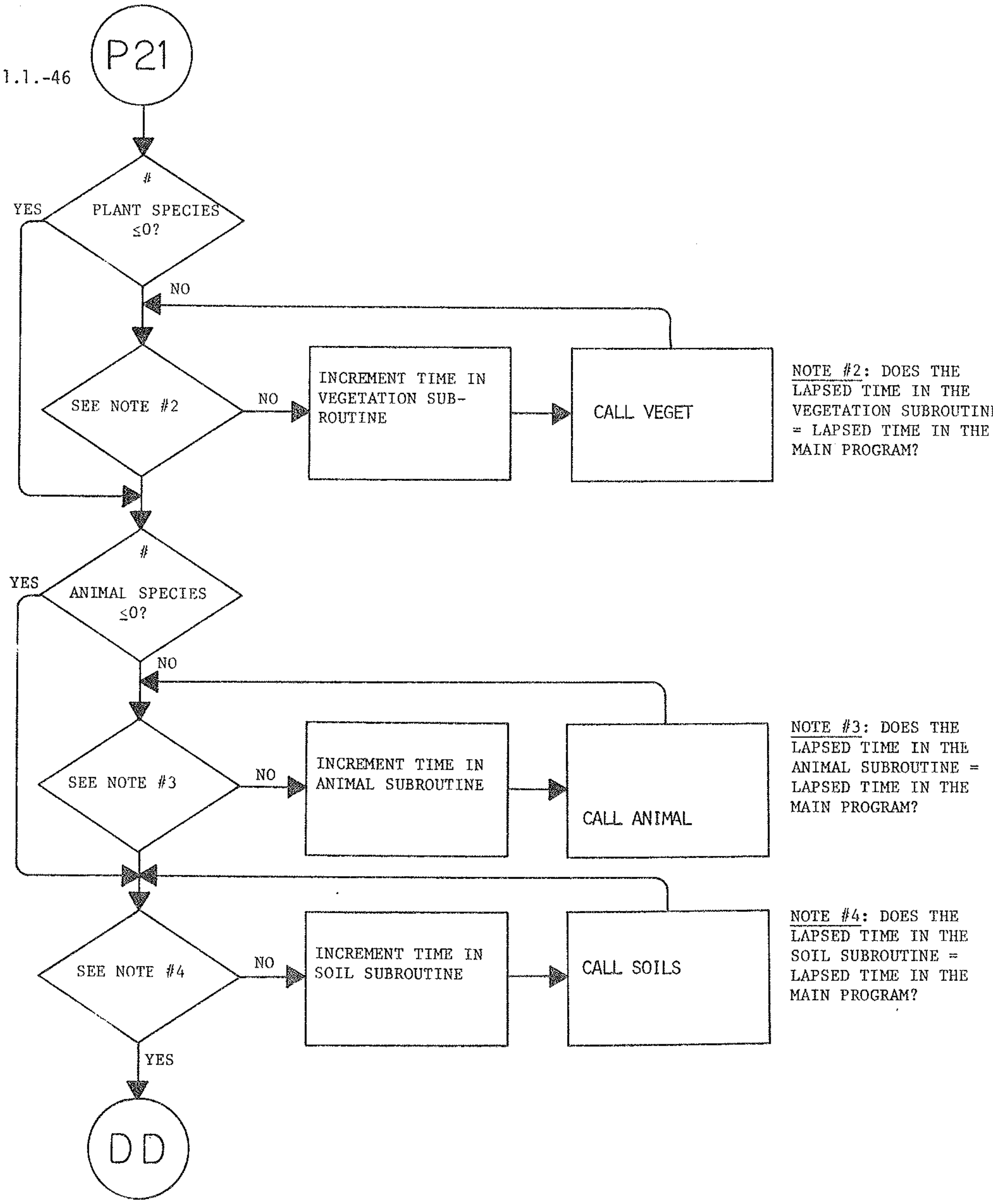

P18
NAME OF CURRENT MONTH, YEAR AND DAY
CALL KOVER
X
ANY GRAPHS DESIRED?
NO
YES
ANY LINE GRAPHS DESIRED?
NO
YES
SET THE GRAPH MATRIX & ASSIGN MODEL VARIABLES TO THE MATRIX ELEMENTS
ANY HISTOGRAMS DESIRED?
NO
Y
YES
SET THE HISTOGRAM MATRIX & ASSIGN THE MODEL VARIABLES TO THE MATRIX ELEMENTS
ANY REPORTS DESIRED FOR SIMULATION?
NO
Y
YES
LL
ARE THE INCRE-MENTATION OPERA-TIONS TIMED?
NO
BB
YES
P19


P19
TIME EXPIRED SINCE LAST INQUIRY
BB
SET SIMULATION TIME PARAMETERS
KK
INITIALIZE PARA- METERS FOR CURRENT LOOP & INCREMENT LOOP
TIME LOOP ATTEMPTED < 20 TIMES?
ERROR
STOP
YES
ASSIGN ALL TIME VARIABLES TO TEMPORARY STORAGE
DD
CUR- RENT DATE TERMINAL SIMULA- TION DATE?
NO
P22
YES
CUR- RENT DATE < INITIAL SIMULA- TION DATE?
YES
EE
NO
INCREMENT THE DATE
P20

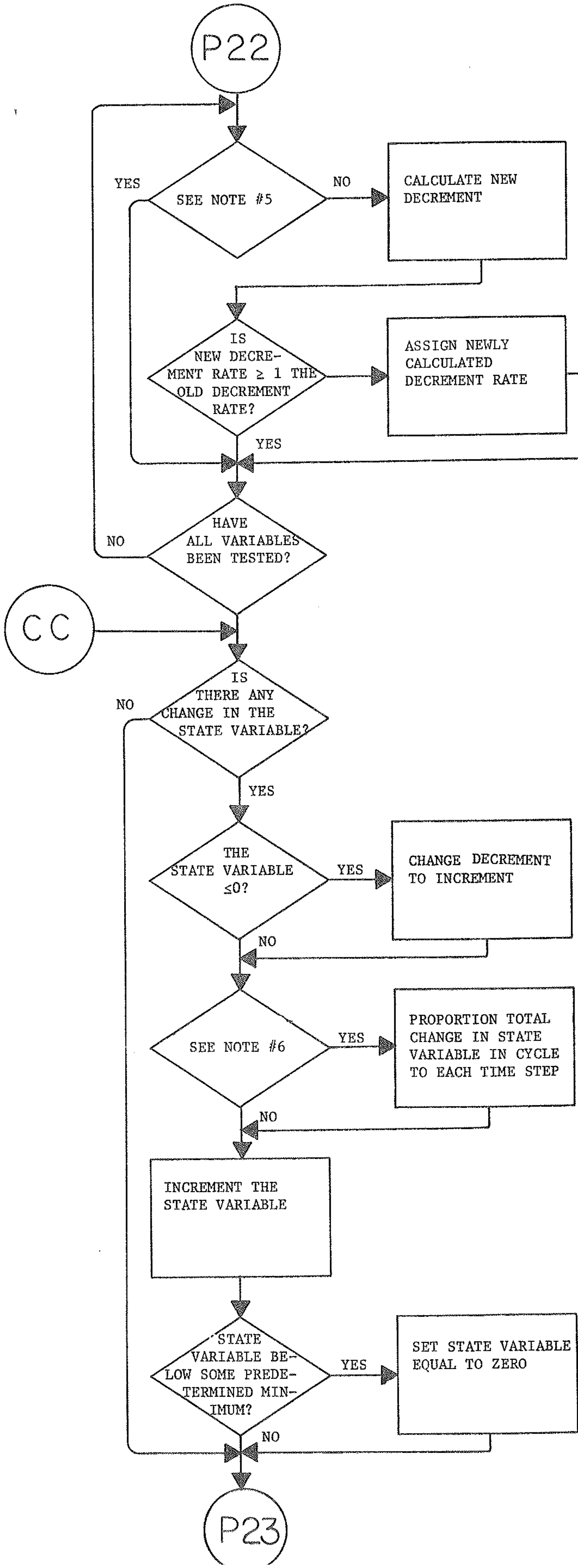


NOTE #1: NUMBER OF UNSUCCESSFUL ATTEMPTS DURING TIME PERIOD >1 OR CURRENT SIMULATION DAY ≤ DAY FOR WHICH PRECIPITATION WAS LAST INCREMENTED?

2.1.3.1.1.-46

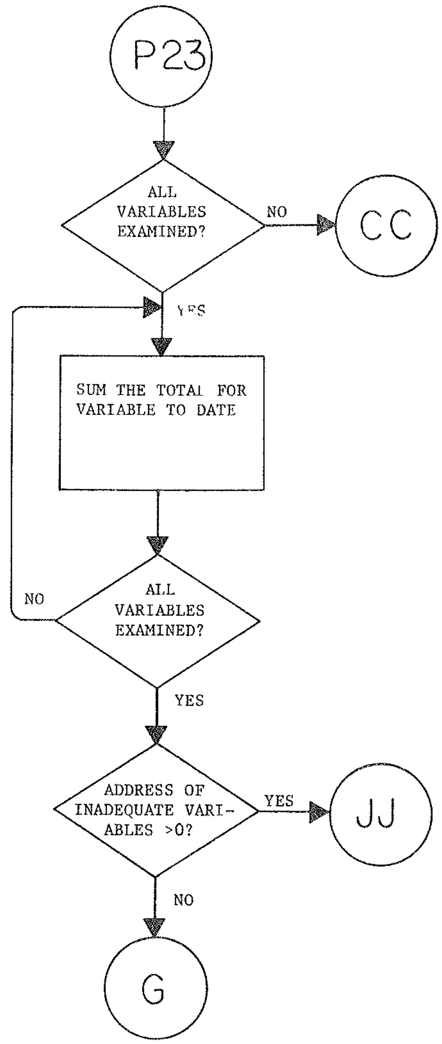

P21
PLANT SPECIES ≤0?
YES
NO
SEE NOTE #2
NO
INCREMENT TIME IN VEGETATION SUB-ROUTINE
CALL VEGET
NOTE #2: DOES THE LAPSED TIME IN THE VEGETATION SUBROUTINE = LAPSED TIME IN THE MAIN PROGRAM?
ANIMAL SPECIES ≤0?
YES
NO
SEE NOTE #3
NO
INCREMENT TIME IN ANIMAL SUBROUTINE
CALL ANIMAL
NOTE #3: DOES THE LAPSED TIME IN THE ANIMAL SUBROUTINE = LAPSED TIME IN THE MAIN PROGRAM?
SEE NOTE #4
NO
INCREMENT TIME IN SOIL SUBROUTINE
CALL SOILS
NOTE #4: DOES THE LAPSED TIME IN THE SOIL SUBROUTINE = LAPSED TIME IN THE MAIN PROGRAM?
YES
DD

NOTE #5: IS THE VALUE OF THE STATE VARIABLE ≤0. OR STATE VARIABLE + ITS DECREMENT ≥0?

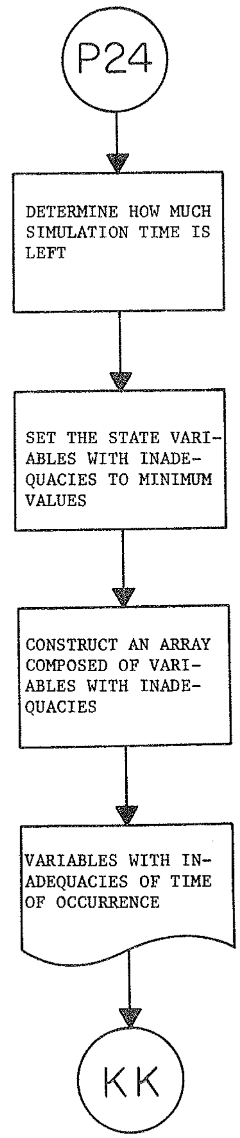


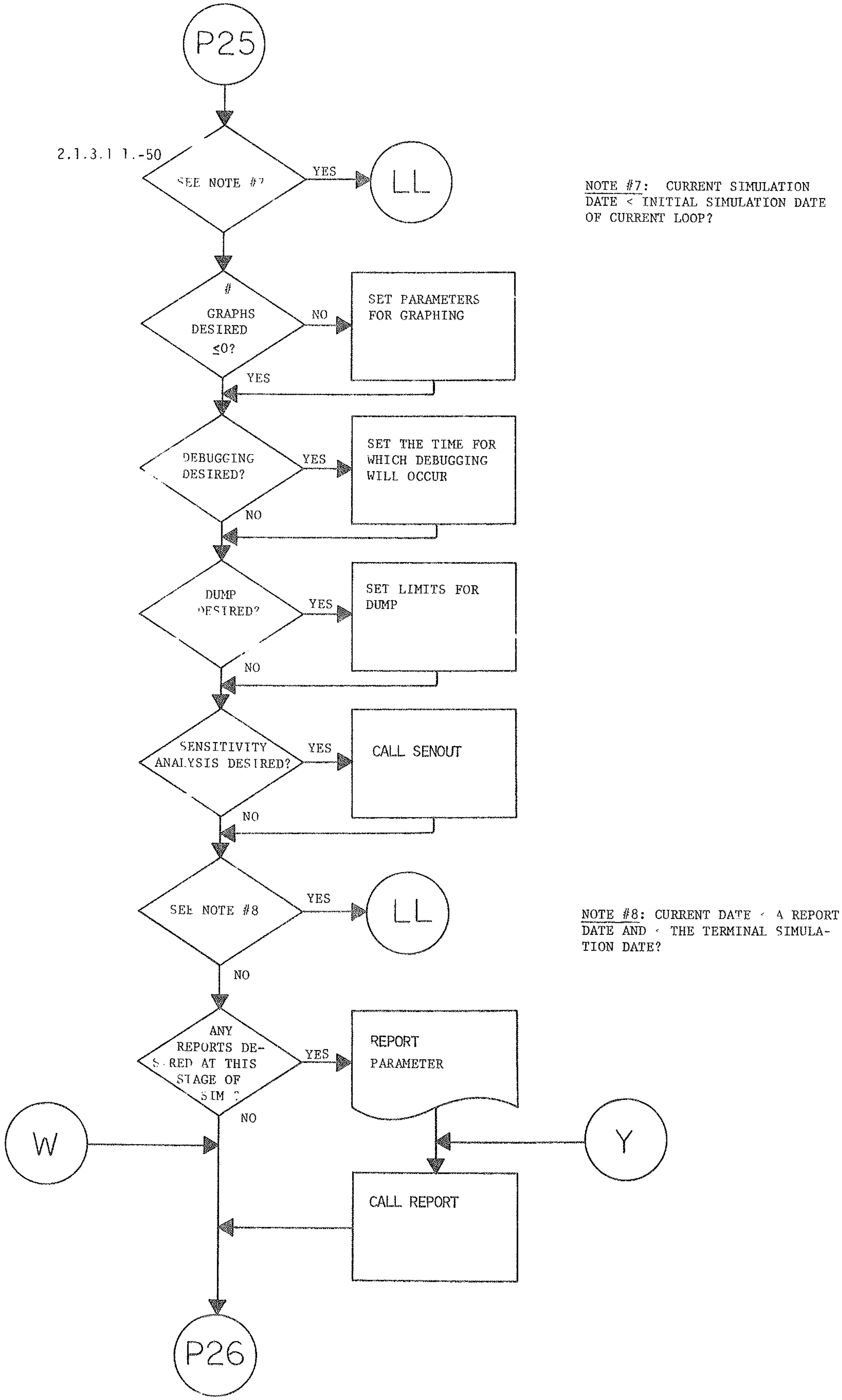
NOTE #6: IS THE TOTAL PROPORTION OF SIMULATION TIME UNIT COMPLETED IN EACH CYCLE <1?

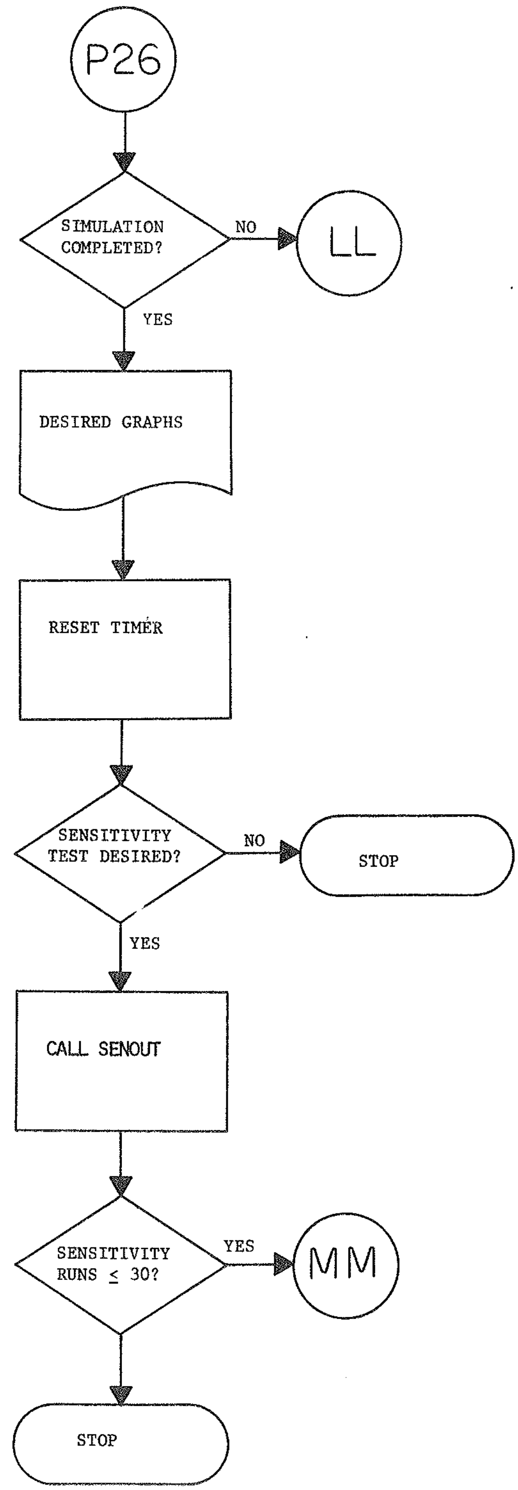
2.1.3.1 1.-48



P23
ALL VARIABLES EXAMINED?
NO
CC
YES
SUM THE TOTAL FOR VARIABLE TO DATE
NO
ALL VARIABLES EXAMINED?
YES
ADDRESS OF INADEQUATE VARI- ABLES >0?
YES
JJ
NO
G


P24
DETERMINE HOW MUCH SIMULATION TIME IS LEFT
SET THE STATE VARIABLES WITH INADEQUACIES TO MINIMUM VALUES
CONSTRUCT AN ARRAY COMPOSED OF VARIABLES WITH INADEQUACIES
VARIABLES WITH INADEQUACIES OF TIME OF OCCURRENCE
KK


P25
2.1.3.1 1.-50
SEE NOTE #7
YES
LL
NOTE #7: CURRENT SIMULATION DATE < INITIAL SIMULATION DATE OF CURRENT LOOP?
#
GRAPHS
DESIRED
≤0?
NO
YES
SET PARAMETERS FOR GRAPHING
DEBUGGING
DESIRED?
YES
NO
SET THE TIME FOR WHICH DEBUGGING WILL OCCUR
DUMP
DESIRED?
YES
NO
SET LIMITS FOR DUMP
SENSITIVITY
ANALYSIS DESIRED?
YES
NO
CALL SENOUT
SEE NOTE #8
YES
LL
NO
NOTE #8: CURRENT DATE < A REPORT DATE AND < THE TERMINAL SIMULATION DATE?
ANY
REPORTS DE-
SIRED AT THIS
STAGE OF
SIM ?
YES
NO
REPORT
PARAMETER
W
Y
CALL REPORT
P26


P26
SIMULATION COMPLETED?
NO
LL
YES
DESIRED GRAPHS
RESET TIMER
SENSITIVITY TEST DESIRED?
NO
STOP
YES
CALL SENOUT
SENSITIVITY RUNS ≤ 30?
YES
MM
STOP

MAIN
PROGRAM LISTING

```
000 C ECOSYSTEM SIMULATION -- CALLING PROGRAM.
000
000 C VARIABLES USED FOR OTHER THAN TEMPORARY PURPOSES ARE DEFINED BELOW.
000 C MOST STATE VARIABLES ARE IN UNITS OF GRAMS PER HECTARE, THEIR
000 C INCREMENTS IN GRAMS PER HECTARE PER TIME UNIT. EXCEPTIONS ARE INDICATED
000 C SPECIFICALLY.
000 C
000 C PROVISION IS MADE FOR PLANT AND ANIMAL SPECIES GROUPS TO BE DIVIDED
000 C INTO DEVELOPMENTAL STAGES OR COHORTS, WHICH ARE NOT NECESSARILY
000 C CONSISTENT AS BETWEEN DIFFERENT SPECIES GROUPS.  IN WHAT FOLLOWS
000 C THE TERM 'COHORT' REFERS TO A PARTICULAR DEVELOPMENTAL STAGE OF A
000 C PARTICULAR SPECIES GROUP.
000
000 C THE FOLLOWING SUBSCRIPTS ARE USED THROUGHOUT THESE EXPLANATORY NOTES.
000 C H = SOIL HORIZON, I = PLANT COHORT, J = PLANT ORGAN TYPE,
000 C K = CHEMICAL CONSTITUENT, L = TYPE OF DEAD ORGANIC MATERIAL,
000 C M = ANIMAL SPECIES GROUP, N = ANIMAL COHORT, P = PATHWAY OF GAIN OR
000 C LOSS TO THE ECOSYSTEM (ATMOSPHERE, SOIL SURFACE, SUBSOIL), S = PLANT
000 C SPECIES GROUP
000 C
000 C ABIOM(N)          CONTENT OF CARBON (ALL FRACTIONS) IN THE N'TH ANIMAL
000 C                  COHORT
000 C ABIOMA           CONTENT OF CARBON (ALL FRACTIONS) TOTALLED OVER ALL
000 C                  ANIMAL COHORTS
000 C ABTOSP(M)        CONTENT OF CARBON (ALL FRACTIONS) IN ALL COHORTS OF
000 C                  THE M'TH ANIMAL SPECIES
000 C ADD              SINGLE-COLUMN INCREMENT FOR GRAPH
000 C AGAIN(K,P)       NET CHANGE IN THE K'TH CONSTITUENT IN THE SYSTEM AS A
000 C                  WHOLE THROUGH THE P'TH CHANNEL (ATMOSPHERE, SURFACE
000 C                  FLOW, SUBSOIL FLOW)
000 C AGAINQ(K,P)      CHANGE PER TIME UNIT IN AGAIN(K,P)
000 C ALINAM(L,ID)     NAME OF THE L'TH CATEGORY OF DEAD MATERIAL (UP TO 16
000 C                  CHARACTERS)
000 C ALIT(L)          CONTENT OF CARBON (ALL FRACTIONS) IN THE L'TH CATEGORY
000 C                  OF DEAD MATERIAL
000 C ALITT            CONTENT OF CARBON (ALL FRACTIONS) IN THE DEAD MATERIAL
000 C AMAXI(II)        MAXIMUM VALUE OF Y AXIS FOR II'TH GRAPH.
000 C AMICRO           VALUE BELOW WHICH STATE VARIABLES WILL BE SET TO
000 C                  ZERO
000 C AMINI(II)        MINIMUM VALUE OF Y AXIS FOR II'TH GRAPH
000 C ANIINC           TIME UNIT FOR SIMULATION IN ANIMAL SUBROUTINE
000 C ANIM(K,M)        CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN ALL COHORTS
000 C                  OF THE M'TH ANIMAL SPECIES GROUP
000 C ANIMCO           TIME FOR ANIMAL SUBROUTINE SINCE COMMENCEMENT
000 C                  OF TIME UNIT LOOP
000 C ANNCOQ           INCREMENT PER TIME UNIT IN ANNCOV
000 C ANNCOV           PROPORTION OF GROUND COVERED BY ALL ANNUAL PLANTS
000 C AORG(K)          CONTENT OF CARBON (ALL FRACTIONS) IN THE K'TH CATEGORY
000 C                  OF SOIL ORGANIC MATTER
000 C AORGH            THE TOTAL CARBON IN ALL SOIL ORGANIC MATTER
000 C AORGT            CONTENT OF CARBON (ALL FRACTIONS) IN THE SOIL ORGANIC
000 C                  MATTER
000 C ASEED(I,H)       THE TOTAL CARBON IN THE SHED SEEDS OF THE I'TH
000 C                  SPECIES AND H'TH SEED HORIZON
000 C ASEEDH(I)        THE TOTAL CARBON IN ALL SHED SEED OF THE I'TH
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```
000  C                   SPECIES
000  C ASEEDT            THE TOTAL CARBON IN ALL SHED SEEDS
000  C ASEEDV (H)        THE TOTAL CARBON IN ALL SHED SEEDS IN THE H'TH SEED
000  C                   HORIZON
000  C ASPNAM(M,I )      NAME OF THE M'TH ANIMAL SPECIES (UP TO 28 CHARACTERS)
000  C ATOT              THE TOTAL CARBON IN DEAD MATERIAL AND SOIL ORGANIC
000  C                   MATTER
000  C ATOTO             THE TOTAL CARBON IN THE ECOSYSTEM
000  C AVEG(I,J)         CONTENT OF CARBON (ALL FRACTIONS) IN THE J'TH ORGAN OF
000  C                   THE I'TH PLANT COHORT
000  C AVEGO(I)          CONTENT OF CARBON (ALL FRACTIONS) IN THE I'TH PLANT
000  C                   COHORT, TOTALED OVER ALL ORGANS
000  C AVEGV( J)         CONTENT OF CARBON (ALL FRACTIONS) IN THE J'TH ORGAN,
000  C                   TOTALED OVER ALL PLANT COHORTS
000  C AVEGVO            CONTENT OF CARBON (ALL FRACTIONS) TOTALLED OVER ALL
000  C                   PLANT COHORTS AND ORGANS
000  C BADD              ORDINATE VALUE FOR GRAPH
000  C BLANK             STORED BLANK FOR HEADINGS
000  C CBIOM(N,K)        CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN THE N'TH
000  C                   ANIMAL COHORT
000  C CBIOMA(K)         CONTENT OF THE K'TH CHEMICAL CONSTITUENT TOTALED OVER
000  C                   ALL ANIMAL COHORTS
000  C CBIOMQ(N,K)       CHANGE DURING THE TIME UNIT IN CBIOM(N,K)
000  C CHNG(II)          CHANGE IN II'TH ACCUMULATOR (IN COMMON BLOCK ACCTNC)
000  C                   (II.LE.LIMACC)
000  C CLIT(L,K)         CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN THE L'TH
000  C                   CATEGORY OF DEAD MATERIAL
000  C CLITQQ(L,K)       CHANGE DURING THE TIME UNIT IN CLIT (L,K)
000  C CLITT(K)          CONTENT OF THE KTH CHEMICAL CONSTITUENT IN DEAD
000  C                   MATERIAL
000  C CMIN(H,K)         THE AMOUNT OF THE K'TH MINERAL IN THE INORGANIC SOIL
000  C                   MATERIAL IN THE H'TH HORIZON
000  C CMINH(K)          THE AMOUNT OF THE K'TH MINERAL ELEMENT IN THE
000  C                   INORGANIC SOIL MATERIAL
000  C CMINQQ(H,K )      THE INCREMENT PER TIME UNIT IN CMIN(H,K)
000  C COHNAM(LL,JJ)     THE NAME OF THE ANIMAL COHORTS DESIGNATED AS 'LL'
000  C                   (JJ = 1,4)
000  C CORG(K)           CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN THE SOIL
000  C                   ORGANIC MATTER
000  C CORGH(K)          THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000  C                   SOIL ORGANIC MATTER (TOTALLED OVER ALL HORIZONS)
000  C CORGQQ(K)         CHANGE DURING THE TIME UNIT IN CORG(K)
000  C COVER (S)         THE DECIMAL FRACTION OF GROUND COVERED BY THE S'TH
000  C                   PLANT SPECIES
000  C COVERQ(S)         INCREMENT PER TIME UNIT IN COVER(S)
000  C CVEG(I,J,K )      CONTENT OF THE K'TH CONSTITUENT IN THE J'TH ORGAN OF
000  C                   THE I'TH PLANT COHORT
000  C CVEGO(I,K)        CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN THE I'TH
000  C                   PLANT COHORT SUMMED OVER ALL ORGANS
000  C CVEGQQ(I,J,K)     CHANGE DURING THE TIME UNIT IN CVEG(I.J.K)
000  C CVEGV(J,K)        CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN THE J'TH
000  C                   ORGAN, SUMMED OVER ALL PLANT COHORTS
000  C CVEGVO(K)         CONTENT OF THE KTH CHEMICAL CONSTITUENT, TOTALED OVER
000  C                   ALL PLANT COHORTS AND ORGANS
000  C DARAIN            THE AMOUNT OF PRECIPITATION IN MM ON THE CURRENT DAY
000  C DAYDAY            INTEGRAL PART OF TIME SINCE COMMENCEMENT OF TIME
000  C                   UNIT LOOP
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```
000   C DECINC(KK)       CHANGE IN KK'TH STATE VARIABLE (KK.LE.LIMIT)
000   C DECJAN(II)       ABBREVIATED NAME OF THE II'TH MONTH
000   C DRYFAV(L,K)      FACTOR RELATING THE AMOUNT OF THE K'TH CHEMICAL
000   C                  CONSTITUENT TO THE DRY MATTER ASSOCIATED WITH IT
000   C                  IN THE L'TH CATEGORY OF MATERIAL
000   C DUMMY(JJ)        ARRAY AVAILABLE FOR EXTRA STATE VARIABLES AS REQUIRED
000   C                  BY SUBROUTINES
000   C DUMMYQ(JJ)       INCREMENT PER TIME UNIT IN DUMMY(JJ)
000   C EROD(P)          ACCUMULATED NET GAIN OR LOSS OF INERT PARTICLES
000   C                  THROUGH THE P'TH CHANNEL (SEE 'AGAIN' ABOVE)
000   C ERODQQ(P)        CHANGE PER TIME UNIT IN EROD(P)
000   C EVAP             THE POTENTIAL EVAPOTRANSPIRATION IN MM. ON THE CURRENT
000   C                  DAY
000   C EXPLA(II,JJ)     IN A GRAPH,EXPLANATION OF THE JJTH VARIABLE - UP TO 20
000   C                  CHARACTERS
000   C EXPLAN(II,JJ)    EXPLANATION (UP TO 20 CHARACTERS) OF JJ'TH LINE IN
000   C                  MULTIPLE-LINE GRAPHS TAKEN TOGETHER
000   C FACTC            PROPORTION OF TIME UNIT STILL TO BE COMPLETED
000   C FACTOR           PROPORTION OF UNIT COMPLETED IN ONE CYCLE OF THE
000   C                  TIME UNIT LOOP
000   C FIG(II,JJ)       IN A GRAPH, VALUE OF THE II'TH VARIABLE FOR THE JJ'TH
000   C                  COLUMN
000   C FIGS (II,JJ)     VALUES OF THE II'TH VARIABLE FOR SUCCESSIVE COLUMNS OF
000   C                  THE JJ'TH GRAPH
000   C FINDAY           A QUANTITY FRACTIONALLY LESS THAN THE TIME AT THE END
000   C                  OF THE CURRENT TIME STEP
000   C FRAC             FRACTIONAL PART OF DAY AT POINT OF TIME REACHED
000   C                  BY SIMULATION
000   C FRANAM(K,JJ)     NAME OF THE K'TH CONSTITUENT, UP TO 16 CHARACTERS
000   C FREWAQ           THE INCREMENT PER TIME UNIT IN FREWAT
000   C FREWAT           THE DEPTH OF FREE WATER OVER THE SOIL SURFACE, IN MM.
000   C HIGH             ARBITRARILY HIGH VALUE TO INITIALIZE MINIMIZATIONS
000   C HORDEP(H)        THE DEPTH IN MM. TO THE BOTTOM OF THE H'TH SOIL HORIZON
000   C H2O(P)           NET GAIN OR LOSS OF WATER THROUGH THE P'TH CHANNEL
000   C                  (SEE 'AGAIN' ABOVE)
000   C H2OQQ(P)         CHANGE PER TIME UNIT IN H2O(P)
000   C IDAY             THE NUMBER OF THE CURRENT DAY - AT THE BEGINNING OF
000   C                  EACH RUN SET EQUAL TO JDAY, AND THEREAFTER INCREMENTED
000   C                  THROUGHOUT THE RUN
000   C IDAYPR           THE DAY ON WHICH PRECMM WAS LAST INCREMENTED
000   C IDAY1            INTEGRAL PART (DAYS) IN TIME AT COMMENCEMENT OF THE
000   C                  TIME UNIT LOOP
000   C IDAY2            INTEGRAL PART (DAYS) IN TIME AT COMPLETION OF TIME
000   C                  UNIT LOOP
000   C IDUMP(II)        THE VALUE OF IDAY AT WHICH THE NEXT DUMP OF STATE
000   C                  VARIABLES IS TO BE MADE.
000   C ILH              THE STARTING ADDRESS IN CLIT OF DEAD ROOT CATEGORIES
000   C ILIT             THE STARTING ADDRESS IN CLIT OF SURFACE LITTER CATEGORIES
000   C IMIN             ADDRESS OF A STATE VARIABLE WHICH IS INADEQUATE TO
000   C                  MEET A PROPOSED DECREMENT.
000   C INITYR           STARTING YEAR
000   C INSTRU(JJ)       SWITCH FOR THE JJ'TH INSTRUCTION TO BE TRANSFERRED TO
000   C                  SUBROUTINES.
000   C IOUNIT           THE LOGICAL UNIT FOR THE NEXT DUMP OF STATE VARIABLES.
000   C IPARAM           THE ADDRESS IN THE COMMON BLOCK /PARAM/ FROM WHICH A
000   C                  PRINT-OUT IS TO START
000   C IREP             THE SERIAL NUMBER OF THE NEXT TABULATED REPORT TO BE
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          000   C                       PRINTED
          000   C IRUN                  RUN COUNTER FOR SENSITIVITY TESTS
          000   C ISENSE                SWITCH, POSITIVE FOR SENSITIVITY TESTS
          000   C ISTD                  THE STARTING ADDRESS IN CLIT OF STANDING DEAD PLANT
          000   C                       CATEGORIES
          000   C ISW                   SWITCH FOR SENOUT SUBROUTINE, 1 DURING RUN, 2 AT
          000   C                       END OF RUN
     NEW  000   C IYR                   CURRENT YEAR
     -01  000   C IYRDAY                CURRENT DAY, COUNTING FROM JANUARY 1 OF THE CURRENT
          000   C                       YEAR
          000   C IYRDAZ                TEMPORARY STORAGE OF IYRDAY DURING TIME UNIT LOOP
          000   C JDAY                  INITIAL DAY OF SIMULATION
          000   C JDUMP                 THE CURRENT ADDRESS IN IDUMP.
          000   C JLH                   THE ENDING ADDRESS IN CLIT OF DEAD ROOT CATEGORIES
          000   C JLIT                  THE ENDING ADDRESS IN CLIT OF SURFACE LITTER
          000   C                       CATEGORIES
          000   C JPARAM                THE ADDRESS IN THE COMMON BLOCK /PARAM/ AT WHICH A
          000   C                       PRINT-OUT IS TO END
          000   C JSTATE                SWITCH TO PERMIT ARRAY 'DUMMY' TO BE PRINTED.
          000   C JSTD                  THE ENDING ADDRESS IN CLIT OF STANDING DEAD PLANT
          000   C                       CATEGORIES
          000   C KDAY                  NUMBER OF DAYS SIMULATED TO DATE
          000   C KDUMP                 THE FINAL ADDRESS IN IDUMP.
          000   C LDEBUG                VALUE OF IDAY AT WHICH EXTRA OUTPUT IS TO CONCLUDE
          000   C LIGRAF(II)            DESIGNATION NUMBER OF THE II'TH VARIABLE TO BE GRAPHED
          000   C                       (ADDRESS IN ARRAY 'STATE', OR IN ARRAY 'SUMS' + 10000,
          000   C                       OR IN ARRAY 'STNG' + 20000)
          000   C LIMACC                SIZE OF ARRAYS STNG,CHNG
          000   C LIMIT                 SIZE OF ARRAYS STATE , DECINC
          000   C LIMTOT                SIZE OF ARRAY SUMS
          000   C LISCOH(N)             THE NUMERICAL DESIGNATION OF THE N'TH ANIMAL COHORT
          000   C LISTER(II)            NUMBER OF CURVES TO BE INCLUDED IN THE II'TH GRAPH
          000   C LISVCO(LL)            THE INTEGRAL LABEL OF THE NAME OF THE LL'TH PLANT
          000   C                       COHORT
          000   C LITCAT(L)             THE ROW OF DRYFAV TO BE USED AS MULTIPLIERS IN
          000   C                       ESTIMATING DRY MATTER FOR THE L'TH CATEGORY OF DEAD
          000   C                       MATERIAL
          000   C LITRUN (L)            THE INTEGRAL LABEL OF THE L'TH CATEGORY OF DEAD
          000   C                       MATERIAL MOVED DURING DEPOSITION EVENTS
          000   C LOOP                  NUMBER OF TIMES THAT THE TIME UNIT LOOP HAS BEEN
          000   C                       ATTEMPTED WITHOUT BEING COMPLETED
          000   C LOOPER                SWITCH TO RESET EXOGEN INDICES - ZERO WHEN IDAY.GT.
          000   C                       IDAY1, OTHERWISE NEGATIVE WHEN LOOP.EQ.1 AND POSITIVE
          000   C                       WHEN LOOP.GT.1
          000   C MDEBUG                VALUE OF IDAY FROM WHICH EXTRA OUTPUT IS TO BEGIN
          000   C MGRA(IT)              TEMPORARY STORAGE OF ADDRESSES OF VARIABLES TO BE
          000   C                       GRAPHED
          000   C MONDAY (I)            THE NUMBER OF DAYS IN THE I'TH MONTH
          000   C MONEND                THE NUMBER OF DAYS FROM JAN. 1 TO THE END OF THE
          000   C                       CURRENT MONTH
          000   C MONENZ                TEMPORARY STORAGE OF MONEND DURING TIME UNIT LOOP
          000   C MONTH                 THE CURRENT MONTH OF THE YEAR
          000   C MONTHZ                TEMPORARY STORAGE OF MONTH DURING TIME UNIT LOOP
          000   C MREP(IT)              DAY FOR THE II'TH REPORT
          000   C NCHAN                 NUMBER OF CHANNELS FOR EXCHANGE WITH SURROUNDINGS
          000   C NCHECK                SWITCH TO INDICATE FIRST USE OF SUBROUTINES
          000   C NCOH(M)               NUMBER OF DEVELOPMENTAL CATEGORIES ( COHORTS ) OF THE
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000  C              M'TH ANIMAL SPECIES
000  C NCOHCH(M)    THE ADDRESS IN LTCOH FOR THE LAST COHORT OF THE M'TH
000  C              ANIMAL SPECIES
000  C NCOHOR       THE NUMBER OF DIFFERENT COHORT NAMES USED
000  C NDAY         FINAL DAY OF SIMULATION
000  C NDEBUG       SWITCH FOR OBTAINING THE VALUES OF THE DAILY
000  C              INCREMENTS TO THE STATE VARIABLES. (1 PRODUCES OUTPUT;
000  C              0 PRODUCES NO OUTPUT)
000  C NDRCAT       NUMBER OF CATEGORIES OF DEAD MATERIAL FOR
000  C              ESTIMATION OF DRY MATTER FROM CONSTITUENTS
000  C NEGATE(II)   THE ADDRESS IN THE /STAT/ COMMON BLOCK OF THE II'TH
000  C              VARIABLE WHICH HAS BEEN DECREMENTED TO ZERO DURING THE
000  C              CURRENT TIME UNIT LOOP
000  C NELEM        NUMBER OF CONSTITUENT ELEMENTS OR GROUPS OF ELEMENTS
000  C NELEMC       NUMBER OF CHEMICAL ELEMENTS OTHER THAN CARBON
000  C NEWREC       A SWITCH, A POSITIVE VALUE OF WHICH PERMITS THE STATE
000  C              VARIABLES TO BE READ FROM LOGICAL UNIT 9 RATHER THAN
000  C              FROM CARDS.
000  C NFRACT       NUMBER OF CARBON FRACTIONS
000  C NFRAC1       STARTING ADDRESS FOR CARBON FRACTIONS IN LIST OF
000  C              CONSTITUENTS
000  C NFRAC2       THE NUMBER OF CARBON FRACTIONS + 2; USED AS A DO LOOP
000  C              PARAMETER
000  C NFRELM       THE TOTAL NUMBER OF CHEMICAL CONSTITUENTS
000  C NHORIZ       NUMBER OF SOIL HORIZONS
000  C NHOR71       NHORIZ + 1 (NEEDED FOR DO-LOOPS)
000  C NOCOL        NUMBER OF COLUMNS IN A HISTOGRAM
000  C NOGRAF       NUMBER OF LINE GRAPHS REQUIRED
000  C NOHIS        NOGRAF+1 (REQUIRED AS ADDRESS IN GRAPH ARRAYS)
000  C NOHIST       NUMBER OF BLOCK GRAPHS REQUIRED
000  C NOHISU       TOTAL NUMBER OF GRAPHS REQURIED
000  C NOINST       NUMBER OF INSTRUCTIONS TO BE TRANSFERRED TO
000  C              SUBROUTINES
000  C NOLIT        NUMBER OF CATEGORIES OF DEAD MATERIAL
000  C NOREP        SWITCH FOR TABULATED REPORTS; 1 FOR OMISSION OF ALL
000  C              BUT INITIAL REPORTS, 2 FOR OMISSION OF ALL, 3 FOR
000  C              OMISSION OF THE INITIAL REPORT ONLY
000  C NORGAN       NUMBER OF ORGANS FOR EACH PLANT COHORT
000  C NOSECS       A SWITCH WHICH PROVIDES FOR TIMING OF OUTPUT
000  C              OPERATIONS AND INCREMENTATIONS OF STATE VARIABLES.
000  C              (0 CAUSES NO TIMING; 1 CAUSES TIMING OF OUTPUT
000  C              OPERATIONS; 2 CAUSES TIMING OF OUTPUT OPERATIONS AND
000  C              INCREMENTATION OPERATIONS)
000  C NOSYM        NUMBER OF VARIABLES IN A SINGLE GRAPH
000  C NOTIME       NUMBER OF SUBROUTINES WITHIN DO-LOOPS
000  C NRA          NUMBER OF RUNS FOR SENSITIVITY TESTS
000  C NRAIN        NUMBER OF DAYS ON WHICH RAIN FALLS
000  C NREP         NUMBER OF TABULATED REPORTS
000  C NREPET(JJ)   NUMBER OF REPETITIONS FOR THE JJ'TH SUBROUTINE
000  C NRUNLT       THE NUMBER OF CATEGORIES OF DEAD MATERIAL MOVED INTO
000  C              THE ECOSYSTEM DURING DEPOSITION EVENTS
000  C NSEEDH       NUMBER OF SOIL HORIZONS WITH BURIED SEED
000  C NSHORT       SWITCH TO INDICATE PROGRAM IS HALTED BY A FAILURE OF
000  C              DECREMENTATION
000  C NSPCOH       TOTAL NUMBER OF DEVELOPMENTAL CATEGORIES (COHORTS) FOR
000  C              ANIMAL SPECIES
000  C NSPECA       NUMBER OF ANIMAL SPECIES CATEGORIES
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000    C NSPECV          NUMBER OF PLANT SPECIES CATEGORIES
000    C NUMMON          THE DATE WITHIN THE CURRENT MONTH
000    C NUMMOZ          TEMPORARY STORAGE OF NUMMON DURRING TIME UNIT LOOP
000    C NUNIT           TIME UNIT FOR SIMULATION IN THOUSANDTHS OF A DAY
000    C NVCOCU (I)      THE ENDING ADDRESS IN LISVCO OF THE I'TH PLANT
000    C                 SPECIES
000    C NVCOH(S)        THE NUMBER OF SIZE OR AGE CLASSES (COHORTS) IN THE
000    C                 S'TH PLANT SPECIES
000    C NVECOH          THE TOTAL NUMBER OF PLANT COHORTS
000    C NVCOHR          THE TOTAL NUMBER OF NAMES OF PLANT COHORTS
000    C NYRDAY          NUMBER OF DAYS IN A YEAR
000    C NYRDAZ          TEMPORARY STORAGE OF NYRDAY DURING TIME UNIT LOOP
000    C ORGNAM(J,K )    NAME OF THE J'TH PLANT ORGAN (UP TO 24 CHARACTERS)
000    C ORIG            STARTING POINT FOR TIME UNIT OF SIMULATION
000    C ORIGIN(II)      SWITCH; MUST BE WORD 'ZERO' IF THE II'TH GRAPH SHOULD
000    C                 BE PRINTED TO INCLUDE Y=0
000    C P(II)           PARAMETER ARRAY FOR THE PROCESS SUBROUTINES
000    C PERCOQ          INCREMENT PER TIME UNIT IN PERCOV
000    C PERCOV          PROPORTION OF GROUND COVERED BY ALL PERENNIAL PLANTS
000    C PERIOD          THE TIME INTERVAL PER COLUMN OF GRAPHS
000    C PLACE(II)       HEADING FOR TABULATED OUTPUT
000    C POP(N)          POPULATION OF THE N'TH ANIMAL COHORT, NUMBER PER
000    C                 HECTARE
000    C POPQQQ(N)       CHANGE DURING THE TIME UNIT IN POP(N)
000    C POPSP(M)        POPULATION OF ALL COHORTS OF THE M'TH ANIMAL SPECIES
000    C                 GROUP, NUMBER PER HECTARE
000    C PRECMM          ACCUMULATED PRECIPITATION IN MILLIMETERS
000    C SAVEG (S,J )    THE CARBON IN THE J'TH ORGAN OF ALL COHORTS IN THE
000    C                 S'TH PLANT SPECIES GROUP
000    C SAVEGO (S)      THE TOTAL CARBON IN ALL COHORTS OF THE S'TH PLANT
000    C                 SPECIES GROUP
000    C SEED (S,H,K)    THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000    C                 SHED SEEDS OF THE S'TH SPECIES AND H'TH HORIZON
000    C SEEDEP(H)       DEPTH (IN MM) OF THE BOTTOM OF THE H'TH HORIZON FOR
000    C                 BURIED SEED (THE FIRST HORIZON CONSISTS OF SEEDS LYING
000    C                 ON THE SURFACE)
000    C SEEDH (S,K )    THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000    C                 SHED SEEDS OF THE S'TH PLANT SPECIES GROUP.
000    C SEEDQQ(I,H,K)   THE INCREMENT IN SEED (I,H,K)
000    C SEEDV (H,K )    THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000    C                 SHED SEEDS OF THE H'TH HORIZON
000    C SEEDVH (K)      THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000    C                 TOTAL SHED SEED BIOMASS
000    C SNOCOV          WEIGHT OF SNOW COVER (G. PER HA.)
000    C SNODEP          DEPTH OF SNOW COVER (MM.)
000    C SOIINC          TIME UNIT FOR SIMULATION IN SOILS SUBROUTINE
000    C SOTLCC          TIME FOR SOILS SUBROUTINE SINCE COMMENCEMENT OF TIME
000    C                 UNIT LOOP
000    C SOILTE(H)       MEAN TEMPERATURE OF THE H'TH SOIL HORIZON
000    C STATE (II)      II'TH STATE VARIABLE (II.LE.LIMIT) (THIS ARRAY IS ALSO
000    C                 USED FOR INITIAL COMMENTS)
000    C STNG(II)        II'TH ACCUMULATOR (IN COMMON BLOCK ACC) (II.LE.LIMACC)
000    C SUMS(II)        II'TH TOTAL (II.LE.LIMTOT)
000    C SVEG(S,J,K)     CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN THE J'TH
000    C                 ORGAN OF ALL COHORTS OF THE S'TH PLANT SPECIES
000    C SVEGO(I,K)      THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN ALL
000    C                 COHORTS OF THE I'TH SPECIES
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000   C TCOVER           THE DECIMAL FRACTION OF GROUND COVERED BY THE ENTIRE
000   C                  PLANT COMMUNITY
000   C TCOVQQ           INCREMENT PER TIME UNIT IN TCOVER
000   C TIMER            TIME EXPIRED SINCE LAST INQUIRY
000   C TITLE (JJ)       TITLE OF A GRAPH - (UP TO 80 CHARACTERS)
000   C TITLES(II,J )    TITLE OF THE II'TH GRAPH, UP TO 80 CHARACTERS
000   C TOT(K)           CONTENT OF THE K'TH CHEMICAL CONSTITUENT IN ALL DEAD
000   C                  MATERIAL + SOIL ORGANIC MATTER
000   C TOTAL(K)         TOTAL OF K'TH CONSTITUENT IN WHOLE ECOSYSTEM.
000   C UNIT             TIME UNIT FOR STIMULATION IN DAYS
000   C VCONAM(LL,JJ)    THE NAME OF THE PLANT COHORTS DESIGNATED AS 'LL'
000   C                  JJ = 1,4)
000   C VEGCC            TIME FOR VEGET SUBROUTINE SINCE COMMENCEMENT OF
000   C                  TIME UNIT LOOP
000   C VEGINC           TIME UNIT FOR STIMULATION IN VEGET SUBROUTINE
000   C VSPNAM (S,JJ)    NAME OF THE S'TH PLANT SPECIES (UP TO 28 CHARACTERS)
000   C WATAQQ(H)        THE INCREMENT PER TIME UNIT IN WATABS(H)
000   C WATABS(H)        THE AMOUNT OF WATER IN THE H'TH SOIL HORIZON (IN MM.)
000   C WATER (H)        THE SOIL WATER TENSION, IN ATMOSPHERES, OF THE H'TH
000   C                  HORIZON
000   C XDOT(II)         VALUE FOR THE II'TH COLUMN OF A BLOCK GRAPH
000   C XMAX             MAXIMUM VALUE FOR X AXIS IN A GRAPH
000   C XMIN             MINIMUM VALUE FOR X AXIS IN A GRAPH
000   C XTITLE(JJ)       TITLE FOR THE X AXIS OF A GRAPH, UP TO 40 CHARACTERS
000   C YAXISS(II, J)    TITLE OF THE Y AXIS IN THE II'TH GRAPH (UP TO 40
000   C                  CHARACTERS)
000   C YMAX             MAXIMUM VALUE FOR Y AXIS IN A GRAPH
000   C YMIN             MINIMUM VALUE FOR Y AXIS IN A GRAPH
000   C YTITLE(JJ)       TITLE FOR THE Y AXIS OF A GRAPH. - UP TO 40 CHARACTERS
000   C ZERO             STORED WORD 'ZERO' FOR COMPARISON WITH ORIGIN
000
000   C-------------------------------------------------------------------
000   C     THE COMMON BLOCK /NAMES/ CONTAINS THE NAMES REQUIRED FOR
000   C     TABULATED OUTPUT
000   C-------------------------------------------------------------------
000         COMMON/NAMES/COHNAM(20,4),VCONAM(10,4),VSPNAM(10,7),ASPNAM(10,7),
000        1 ORGNAM(10,6),FRANAM(10,3),ALINAM(15,6)
000   C------------------------------------------------------------------------
000   C     COMMON BLOCK /ACC/ CONTAINS ACCUMULATED CHANGES, WHICH MAY BE
000   C     NEGATIVE.  COMMON BLOCK /ACCINC/ CONTAINS THE INCREMENTS TO THE
000   C     ARRAYS IN /ACC/ FOR A SINGLE TIME UNIT.
000   C------------------------------------------------------------------------
000         COMMON /ACC/ AGAIN(3,4),EROD(3),H2O(3)
000         COMMON /ACCINC/ AGAINQ(3,4),ERODQQ(3), H2OQQQ(3)
000   C------------------------------------------------------------------------
000   C     COMMON BLOCK /SPEC/ CONTAINS SPECIFICATIONS AND OTHER INFORMATION
000   C     COMMON TO THE WHOLE SET OF PROGRAMS, BUT EXCLUDING STATE AND
000   C     EXOGENOUS VARIABLES.
000   C------------------------------------------------------------------------
000         COMMON/SPEC/NCHAN,INSTRU(20),         NSPECV,NSPECA,NORGAN,NFRACT,
000        1 NDAY,NELEM,NOLIT,NCHECK,IDAY,IYRDAY,NREPET(20),NDEBUG,NHORIZ
000        2,NCOH(10),LISCOH(30),NCOHCU(10),NCOHOR,NFRELM,NFRAC1,NSPCOH,MONTH,
000        3 HORDEP(6),LITRUN(5),MREP(20),IYR,DRYFAV(3,6),LITCAT(15)
000        4,NVECOH,LISVCO(15),NVCOH(10),NVCOCU(10),NOSECS,IRUN,NRUNLT
000        5,ISTD,JSTD,ILIT,JLIT,ILH,JLH,SEEDEP(6),NSEEDH,NELEMS,JSTATE,JDAY
000        6,LOOPER
000   C------------------------------------------------------------------------
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000   C     COMMON BLOCK /OTHER/ CONTAINS A NUMBER OF VARIABLES OTHER THAN
000   C     STATE VARIABLES NEEDED FOR COMMUNICATION BETWEEN THE MAIN PROGRAM
000   C     AND SUBROUTINES.
000   C-----------------------------------------------------------------------
000         COMMON/OTHER/ATOT,ATOTO,SNODEP,SOILTE(5),PRECMM, WATER(5)
000   C-----------------------------------------------------------------------
000   C     COMMON BLOCK /METEOR/ CONTAINS THE VALUES OF EXOGENOUS VARIABLES
000   C     FOR THE CURRENT TIME UNIT.
000   C-----------------------------------------------------------------------
000         COMMON/METEOR/ADUMMY(65),DASNOW,DARAIN
000   C-----------------------------------------------------------------------
000   C     COMMON BLOCK /TOTALS/ CONTAINS SUMS OF THE STATE VARIABLES,
000   C     TOGETHER WITH CERTAIN OTHER VARIABLES REQUIRING INITIALIZATION
000   C     BUT NOT INCREMENTATION AT EACH TIME UNIT.
000   C-----------------------------------------------------------------------
000         COMMON/TOTALS/CVEGV(10,6),CVEGO(15,6),CVEGVO(6),AVEGV(10),AVEGO(15 MN 0
000        1),AVEGVO,ABIOMA,CBIOMA(6),ALITT,CLITT(15),SEEDVH(6),ABIOSP(10),     M
000        2TOT(6),POPSP(10),AVEG(15,10),ABIOM(30),ALIT(15),AORG(5),TOTAL(6),   M
000        3ANIM(10,6),SVEG(10,10,6),SAVEG(10,10),SVEGO(10,6),SAVEGO(10)
000        4 ,ASEED(10,6),ASEEDV(6),ASEEDH(10),ASEEDT,SEEDV(6,6),SEEDH(10,6),
000        5 CORGH(6),AORGH, CMINH(6)
000   C-----------------------------------------------------------------------
000   C     COMMON BLOCK /STAT/ CONTAINS THE STATE VARIABLES, AND /CHANGE/
000   C     THEIR INCREMENTS OR DECREMENTS FOR THE CURRENT TIME UNIT.
000   C-----------------------------------------------------------------------
000         COMMON/STAT/CVEG(15,10,6),SEED(10,6,6),POP(30),CBIOM(30,6),
000        1 CLTT(15,6), CORG(5,6), CMIN(5,6), SNOCOV,WATABS(5),
000        2 ANNCOV,PERCOV,TCOVER,COVER(10),FREWAT,DUMMY(300)
000         COMMON /CHANGE/CVEGQQ(15,10,6),SEEDQQ(10,6,6),POPQQQ(30),
000        1CBIOMQ(30,6),CLITQQ(15,6),CORGQQ(5,6),CMINQQ(5,6)
000        2 ,SNOCOQ,WATABQ(5),          ANNCOQ,PERCOQ,TCOVQQ,COVERQ(10),
000        3 FREWAQ, DUMMYS(300)
000   C-----------------------------------------------------------------------
000   C     COMMON BLOCK /DIAGR/ CONTAINS INFORMATION REQUIRED FOR GRAPHS.
000   C-----------------------------------------------------------------------
000         COMMON/DIAGR/FIG  (8,70),EXPLA (5, 8),TITLE(20),YTITLE(10),     MAIN0340
000        1 XDOT(71), XMAX, XMIN, YMAX, YMIN, NOSYM, INITYR
000   C-----------------------------------------------------------------------
000   C     COMMON BLOCK /PARAM/ CONTAINS THE VALUES OF PARAMETERS USED BY THE
000   C     PROCESS SUBROUTINES.
000   C-----------------------------------------------------------------------
000         COMMON /PARAM/ P(10200)
000         DIMENSION ORIGIN(30),LIGRAF(30),STNG(18),CHNG(18),MONDAY(12),
000        1 PLACE(20),DECJAN(12),NEGATE(20),MCRA(8),REST(14),IDUMP(5)
000         DIMENSION AMAXI(30), AMINI(30), FIGS(30,70),  EXPLAN(5,30)      MAIN0070
000         DIMENSION STATE (1940), DECINC(1940), SUMS(1459)
000         DIMENSION TITLES(30,20), YAXTSS(30,10),LISTER(10)              MAIN0090
000         EQUIVALENCE (STNG,AGAIN),(CHNG,AGAINQ),(REST,ATOT)
000         EQUIVALENCE (STATE, CVEG), (DECINC, CVEGQQ),(SUMS,CVEGV)        MAIN0370
000         DATA AMICRO/.001/,HIGH/1.E20/,NYRDAY/365/,NOCOL/71/,FRAC/0./    MAIN0380
000         DATA IOUNIT/10/, JDUMP/1/
000         DATA LIMTOT/1459/, LIMACC/18/, LIMIT/1940/
000         DATA NREPET/20*1/,BLANK/' '/, IMIN/0/, LOOP/0/, NDEBUG/0/
000         DATA MONDAY/31,28,31,30,31,30,2*31,30,31,30,31/,JXXX/0/         MAIN0410
000         DATA DECJAN/'JAN','FEB','MAR','APR','MAY','JUNE','JULY','AUG',  MAIN0420
000        1 'SEPT','OCT','NOV','DEC'/,ZERO/'ZERO'/,ORIGIN/30*' '/
000         TIMER= EXTIME(G)                                                MAIN0440
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      TRUN = 1                                                    MAIN0450
      NCHAN = 3                                                   MAIN0460
      JDAY =                                                      MAIN0470
      JY = 2                                                      MAIN0480
   10 FORMAT (/////)                                              MAIN0490
      WRITE (6,10)                                                MAIN0500
C-----------------------------------------------------------------------
C     COMMENTS ARE READ IN AND PRINTED OUT UNTIL A BLANK CARD
C     IS ENCOUNTERED
C-----------------------------------------------------------------------
   20 READ (5,250) (STATE(I), I=1,20)                             MAIN0510
      WRITE(6,30 ) (STATE(I), I=1,20)                             MAIN0520
   30 FORMAT (1H0, 10X, 20A4)                                     MAIN0530
      DO 40 I = 1, 20                                             MAIN0540
      IF (STATE(I).NE.BLANK) GO TO 20                             MAIN0550
   40 CONTINUE                                                    MAIN0560
      DO 50 I = 1, LIMIT                                          MAIN0570
      STATE(I) = 0.                                               MAIN0580
   50 DECINC(I) = 0.                                              MAIN0590
      DO 60 I=1,LIMACC                                            MAIN0600
      SINC(I)=0.                                                  MAIN0610
   60 CHNG(I) = 0.                                                MAIN0620
      PREOMM = 0.                                                 MAIN0630
      NCHECK = 0                                                  MAIN0640
C-----------------------------------------------------------------------
C     A HEADING TO READ IN FOR TABULAR OUTPUT
C-----------------------------------------------------------------------
      READ(5,250)  (PLACE(I), I=1,20)                             MAIN0650
C-----------------------------------------------------------------------
C     SPECIFICATIONS, SWITCHES AND INSTRUCTIONS ARE READ IN
C-----------------------------------------------------------------------

C..........N.B. NELEM, THE NUMBER OF CONSTITUENT ELEMENTS MODELLED, IS
C..........ASSUMED TO INCLUDE CARBON UNLESS TWO OR MORE CARBON
C..........FRACTIONS (THE NUMBER OF WHICH IS GIVEN IN NFRACT) ARE
C..........DISTINGUISHED.
      READ (5,230) NSPECV,NSPECA,NORCAN,NFRACT,NELEM,NOLIT,NCOHOR,
     1 NVCOHR,NHORIZ,NSEEDH,NDRCAT,NUNIT,NOINST,NOTIME
      READ (5,230) JDAY, IYR, NDAY, NREP, NOGRAF, NOHIST
NEW   INITYR = IYR
      JDAYPR = JDAY - 1
      IF (NREP.GT.0) GO TO 63
      NREP = 1
      MREP(1) = NDAY
      GO TO 66
   63 READ (5,230) (MREP(I), I = 1, NREP)
   66 NELEMS = NELEM
      READ(5,230) MDEBUG,LDEBUG,NOSECS,ISENSE,NOREF,JSTATF,IPARAM,JPARAM
     1 ,NEWBEG,KDUMP,(IDUMP(I), I=1,KDUMP)
      IF ((MDEBUG.GT.0).AND.(MDEBUG.LE.JDAY)) NDEBUG = 1
      IF (LDEBUG.LT.MDEBUG) LDEBUG = NDAY
      IF(NFRACT.LE.0)  NELEMS = NELEM- 1                          MAIN0730
      IF (NUNIT.LE.0) NUNIT = 1000                                MAIN0740
      UNIT = FLOAT(NUNIT) * .001                                  MAIN0750
      IF (NFRACT.LE.1) NFRACT = 0                                 MAIN0760
      IF (NDRCAT.LE.2) NDRCAT = 7
      IF (NSEEDH.LE.0) NSEEDH = 1                                 MAIN0770
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000        IF(NHORIZ.LE.0)NHORIZ=1                                              MAIN0780
000        IF (NORGAN.LE.0)  NORGAN= 1                                          MAIN0790
000
000   C..........INSTRUCTIONS TO PROCESS SUBROUTINES ARE PROVIDED
000        IF (NOINST.GT.0) READ(5,230) (INSTRU(I),I=1,NOINST)                  MAIN0800
000        IF (NOTIME.LE.0) GO TO 80                                            MAIN0810
000
000   C..........FREQUENCY OF REPETITION OF PROCESS SUBROUTINES WITHIN A
000   C..........TIME UNIT IS SPECIFIED
000        DO 70 I = 1, NOTIME                                                  MAIN0820
000     70 READ (5,230) J, NREPET(J)                                            MAIN0830
000     80 NFRAC1 = NFLEMS + 1                                                  MAIN0840
000        VEGTNC = UNIT/FLOAT(NREPET(1)) - .00001                              MAIN0850
000        ANTINC = UNIT/FLOAT(NREPET(2)) - .00001                              MAIN0860
000        SOIINC = UNIT/FLOAT(NREPET(3)) - .00001                              MAIN0870
000        NFRELM=NFRACT+NFLEM                                                  MAIN0880
000        NFRAC2=NFRACT+2                                                      MAIN0890
000        IF (NSPECV.LE.0) GO TO 150                                           MAIN0900
000   C-----------------------------------------------------------------------------
000   C     THE STAGES OF DEVELOPMENT FOR THE DIFFERENT PLANT SPECIES GROUPS
000   C     ARE SPECIFIED
000   C-----------------------------------------------------------------------------
000        IF (NVCOHR.GT.1) GO TO 100                                           MAIN0910
000        DO 90 I = 1, NSPECV                                                  MAIN0920
000        NVCOCU(I) = I                                                        MAIN0930
000     90 NVCOH(I) = 1                                                         MAIN0940
000        GO TO 150                                                            MAIN0950
000
000   C..........THE NUMBER OF STAGES OF DEVELOPMENT FOR EACH PLANT GROUP
000   C..........ARE READ.
000    100 READ (5,230) (NVCOH(I), I=1,NSPECV)                                  MAIN0960
000        NVCOCU(1) = NVCOH(1)                                                 MAIN0970
000        K1 = 0                                                               MAIN0980
000        DO 140 I = 1, NSPECV                                                 MAIN0990
000        J = NVCOH(I)                                                         MAIN1000
000        IF (I.GT.1) NVCOCU(I) = NVCOCU(I-1) + J                              MAIN1010
000        IF (J.LE.0) J=1                                                      MAIN1020
000        IF (J.LE.NVCOHR) GO TO 110                                           MAIN1030
000        WRITE (6,180) I, NVCOHR                                              MAIN1040
000        STOP                                                                 MAIN1050
000    110 K = K1 + 1                                                           MAIN1060
000        K1 = K1 + J                                                          MAIN1070
000        IF (J.LE.1) GO TO 140                                                MAIN1080
000        IF (J.LT.NVCOHR) GO TO 130                                           MAIN1090
000
000   C..........IF THE NUMBER OF STAGES OF DEVELOPMENT FOR THIS SPECIES
000   C..........GROUP IS MORE THAN ONE AND LESS THAN THE MAXIMUM, THEY ARE
000   C..........SPECIFIED.
000        DO 120 L = K, K1                                                     MAIN1100
000    120 LISVCO(L) = L - K + 1                                                MAIN1110
000        GO TO 140                                                            MAIN1120
000    130 READ (5,230) (LISVCO(L), L = K, K1)                                  MAIN1130
000    140 CONTINUE                                                             MAIN1140
000    150 IF (NSPECA.LE.0) GO TO 270                                           MAIN1150
000   C-----------------------------------------------------------------------------
000   C     THE STAGES OF DEVELOPMENT FOR THE DIFFERENT ANIMAL SPECIES
000   C     GROUPS ARE SPECIFIED.
```

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C-----------------------------------------------------------------------
      IF (NCOHOR.GT.1) GO TO 170                                        MAIN1160
      DO 160 I = 1, NSPECA                                              MAIN1170
      NCOHCU(I) = I                                                     MAIN1180
  160 NCOH(I) = 1                                                       MAIN1190
      GO TO 270                                                         MAIN1200

C..........THE NUMBER OF STAGES OF DEVELOPMENT FOR EACH ANIMAL GROUP
C..........ARE READ.
  170 READ(5,230)(NCOH(I),I=1,NSPECA)                                   MAIN1210
      NCOHCU(1) = NCOH(1)                                               MAIN1220
      K1=0                                                              MAIN1230
      DO 220 I = 1, NSPECA                                              MAIN1240
      J=NCOH(I)                                                         MAIN1250
      IF (I.GT.1) NCOHCU(I) = NCOHCU(I-1) + J                           MAIN1260
      IF(J.LE.0)J=1                                                     MAIN1270
      IF(J.LE.NCOHOR)GO TO 190                                          MAIN1280
      WRITE (6,180)I,NCOHOR                                             MAIN1290
  180 FORMAT('0NUMBER OF COHORTS FOR SPECIES',I3,'EXCEEDS',I3)          MAIN1300
      STOP                                                              MAIN1310
  190 K=K1+1                                                            MAIN1340
      K1=K1+J                                                           MAIN1350
      IF(J.LE.1) GO TO 220                                              MAIN1360
      IF (J.LT.NCOHOR)GO TO 210                                         MAIN1370

C..........IF THE NUMBER OF STAGES OF DEVELOPMENT FOR THIS SPECIES
C..........GROUP IS MORE THAN ONE AND LESS THAN THE MAXIMUM, THEY ARE
C..........SPECIFIED.
      DO 200 L=K,K1                                                     MAIN1380
  200 LISCOH(L)=L-K+1                                                   MAIN1390
      GO TO 220                                                         MAIN1400
  210 READ(5,230)(LISCOH(L),L=K,K1)                                     MAIN1410
  220 CONTINUE                                                          MAIN1420
  230 FORMAT (16I5)                                                     MAIN1430
  240 FORMAT (8F10.2)                                                   MAIN1440
  250 FORMAT (20A4)                                                     MAIN1450
  260 FORMAT (1X, 30A4)                                                 MAIN1460
C-----------------------------------------------------------------------
C     THE NAMES OF THE VARIOUS ECOSYSTEM COMPONENTS ARE READ IN.
C-----------------------------------------------------------------------
  270 IF(NSPECV.GT.0)READ(5,280)((VSPNAM(I,J),J=1,7),I=1,NSPECV)        MAIN1470
  280 FORMAT (14A4)                                                     MAIN1480
      IF(NSPECA.GT.0)READ(5,280)((ASPNAM(I,J),J=1,7),I=1,NSPECA)        MAIN1490
      IF (NORGAN.LE.1) GO TO 300                                        MAIN1500
      READ(5,290)((ORGNAM(I,J), J = 1, 6), I=1,NORGAN)                  MAIN1510
  290 FORMAT (18A4)                                                     MAIN1520

C..........N.B. IF CARBON FRACTIONS ARE NOT DISTINGUISHED, TOTAL
C..........CARBON IS ASSUMED TO HAVE THE LAST PLACE IN THE LIST OF
C..........CONSTITUENTS.
  300 READ (5,250)((FRANAM(I,J), J = 1,3), I=1,NFRELM)                  MAIN1560
      IF (NVCOHR.GT.1)READ(5,250) ((VCONAM(I,J),J=1,4),I=1,NVCOHR)      MAIN1570
      IF  (NCOHOR.GT.1) READ(5,250) ((COHNAM(I,J),J=1,4),I=1,NCOHOR)    MAIN1580
      IF(NOLIT.GT.0) READ(5,290) ((ALINAM(I,J),J=1,6),I=1,NOLIT)        MAIN1590
C-----------------------------------------------------------------
C     INFORMATION FOR DRY-MATTER CALCULATIONS IS READ IN.
C-----------------------------------------------------------------
```

```
000           IF (NOLIT.GT.0) READ(5,230) (LITCAT(I), I=1,NOLIT)           MAIN1600
000           DO 310 J = 1, NORCAT                                         MAIN1610
000       310 READ (5,240) (DRYFAV(J,I), I=1,NFRELM)                       MAIN1620
000     C-------------------------------------------------------------
000     C     INFORMATION ABOUT DEPTHS OF SOIL HORIZONS, AND THE VERTICAL
000     C     DISTRIBUTION OF SEEDS AND DEAD MATERIAL, IS READ IN.
000     C-------------------------------------------------------------
000           IF (NOLIT.GT.0) READ (5,230) ISTD, JSTD, ILIT, JLIT, ILH, JLH   MAIN1630
000           SEEDEP(1) = 0.                                               MAIN1640
000           IF (NSEEDH.GT.1) READ (5,240) (SEEDEP(I), I=2,NSEEDH)        MAIN1650
000       320 NHORZ1 = NHORIZ + 1                                          MAIN1660
000           HORDEP(1) = 0.                                               MAIN1670
000           READ (5,240) (HORDEP(I), I=2,NHORZ1)                         MAIN1680
000     C-----------------------------------------------------------------------
000     C     INITIAL VALUES FOR THE STATE VARIABLES ARE READ IN, FROM AN
000     C     INPUT FILE IF THE SWITCH NEWBEG IS POSITIVE, OTHERWISE FROM CARD
000     C     INPUT.
000     C-----------------------------------------------------------------------
000           IF  (NEWBEG.LE.0) GO TO 330
000           REWIND 9
000           READ (9) STATE
000           GO TO 420
000       330 IF (NSPECV.LE.0) GO TO 360                                   MAIN1690
000           NVECOH = NVCOCU(NSPECV)                                      MAIN1700
000
000     C..........PLANT CONSTITUENTS
000           DO 340 I = 1, NVECOH                                         MAIN1710
000           DO 340 J = 1, NORGAN                                         MAIN1720
000           READ (5,240) (CVEG(I,J,K), K = 1, NFRELM)                    MAIN1730
000       340 CONTINUE                                                     MAIN1740
000
000     C..........CONSTITUENTS OF SHED SEEDS
000           DO 350 I=1,NSPECV                                            MAIN1750
000           DO 350 J = 1 , NSEEDH                                        MAIN1760
000       350 READ (5,240) (SEED(I,J,K), K=1,NFRELM)                       MAIN1770
000       360 IF (NSPECA.LE.0) GO TO 380                                   MAIN1780
000           DO 370 K = 1, NSPECA                                         MAIN1790
000           K1=1                                                         MAIN1800
000           IF(K.GT.1) K1=NCOHCU(K-1)+1                                  MAIN1810
000           K2=NCOHCU(K)                                                 MAIN1820
000
000     C..........ANIMAL POPULATIONS
000           READ(5,240) (POP(J), J=K1,K2)                                MAIN1830
000           DO370J=K1,K2                                                 MAIN1840
000
000     C..........ANIMAL CONSTITUENTS
000       370 READ (5,240)(CATOM(J,I), I = 1, NFRELM)                      MAIN1850
000           NSPCOH=NCOHCU(NSPECA)                                        MAIN1860
000       380 IF (NOLIT.LE.0) GO TO 400                                    MAIN1870
000
000     C..........CONSTITUENTS OF DEAD MATERIAL
000           DO 390 I = 1, NOLIT                                          MAIN1880
000       390 READ (5,240) (CLIT(I,K), K = 1,NFRELM)                       MAIN1890
000
000     C..........CONSTITUENTS OF SOIL
000       400 DO 410 I = 1, NHORIZ                                         MAIN1900
000           READ (5,240) (CORG(I,K), K=1,NFRELM)                         MAIN1910
```

```
000    410 READ (5,240) (CMIN(I,K), K=1,NELEMS), WATABS(I)
000        READ (5,240) SNODEP,SNOCOV,FREWAT
000    C---------------------------------------------------------------------
000    C      THE STATE VARIABLES ARE TOTALLED
000    C---------------------------------------------------------------------
000
000    C..........THE TOTAL ARRAYS ARE INITIALIZED
000    420 IF (LOOP.LE.1) GO TO 428
000        LOOP1 = LOOP - 1
000        DO 425 I = 1, LOOP1
000        IMIN = NEGATE(I)
000        STATE(IMIN) = -STATE(IMIN) - AMICPO
000    425 IF (ABS(STATE(IMIN)).LE.AMICPO) STATE(IMIN) = 0.
000        IMIN = 0
000    428 DO 430 I = 1, LIMTOT
000    430 SUMS(I) = 0.                                                   MAIN1950
000    435 IF (NSPECV.LE.0) GO TO 520
000
000    C..........PLANT STATE VARIABLES ARE TOTALLED
000        DO 460 I = 1, NVECOH                                           MAIN1970
000        DO 460 J = 1, NORGAN                                           MAIN1980
000        DO 436  K = 1, NFRELM
000        IF (CVEG(I,J,K).EQ.0.) GO TO 437
000    436 CONTINUE
000        GO TO 439
000    437 DO 438 K = 1, NFRELM
000    438 CVEG(I,J,K) = 0.
000    439 IF (NFRACT.GT.1) GO TO 440
000        IF (CVEG(I,J,NFRELM).GT.0.) AVEG(I,J) = CVEG(I,J,NFRELM)
000        GO TO 460                                                      MAIN2010
000    440 DO 450 K1 = 1, NFRACT                                          MAIN2020
000        K = K1+NELEM                                                   MAIN2030
000        A = CVEG(I,J,K)                                                MAIN2040
000        IF (A.LE.0.) GO TO 450
000        AVEGV(J) = AVEGV(J) + A                                        MAIN2050
000        AVEG(I,J) = AVEG(I,J) + A                                      MAIN2060
000    450 CONTINUE                                                       MAIN2070
000    460 CONTINUE                                                       MAIN2080
000    470 DO 490 K = 1, NFRELM                                           MAIN2090
000        DO 490 I = 1, NVECOH                                           MAIN2100
000        DO 480 J = 1, NORGAN                                           MAIN2110
000        A = CVEG(I,J,K)
000        IF (A.LE.0.) GO TO 480
000        CVEGO(I,K) = CVEGO(I,K) + A
000    480 CONTINUE
000    490 CVEGVO (K) = CVEGVO (K) + CVEGO (I,K)                          MAIN2130
000        DO 510 I = 1, NVECOH                                           MAIN2140
000        DO 500 J = 1, NORGAN                                           MAIN2150
000    500 AVEGO(I) = AVEGO(I) + AVEG(I,J)                                MAIN2160
000    510 AVEGVO = AVEGVO + AVEGO(I)                                     MAIN2170
000    520 IF (NOLIT.LE.0) GO TO 550                                      MAIN2180
000
000    C..........STATE VARIABLES FOR DEAD MATERIAL ARE TOTALLED
000        DO 540 I = 1, NOLIT                                            MAIN2190
000        DO 530 K1 = 1, NFRELM                                          MAIN2200
000        A = CLIT(I, K1)
000        IF (A.LE.0.) GO TO 530
```

```
000          IF (K1.GT.NELEM) ALIT(I) = ALIT(I) + A
000          CLITT(K1) = CLITT(K1) + A
000      530 CONTINUE
000          IF ((ALIT(I).LE.0.).AND.(CLIT(I,NFRELM).GT.0.))ALIT(I) =
000         1 CLIT(I,NFRELM)
000      540 ALITT = ALITT + ALIT(I)                                    MAIN2240
000
000     C..........SOIL STATE VARIABLES ARE TOTALLED
000      550 DO 570 I = 1, NHORIZ                                       MAIN2250
000          DO 560 K1 = 1, NFRELM                                      MAIN2260
000          A = CORG(I,K1)
000          IF (A.LE.0.) GO TO 560
000          IF (K1.GT.NELEM) AORG(I) = AORG(I) + A
000          CORGH(K1) = CORGH(K1) + A
000      560 IF (CMIN(I,K1).GT.0.) CMINH(K1) = CMINH(K1) + CMIN(I,K1)
000          IF((AORG(I).LE.0.).AND.(CORG(I,NFRELM).GT.0.)) AORG(I) =
000         1 CORG(I,NFRELM)
000      570 AORGT = AORGT + AORG(I)                                    MAIN2310
000          IF (NSPECV.LE.0) GO TO 700                                 MAIN2320
000
000     C..........PLANT STATE VARIABLES ARE TOTALLED BY ORGANS
000          DO600 J = 1, NORGAN                                        MAIN2330
000          DO 590 K = 1, NFRELM                                       MAIN2340
000          DO 580 I = 1, NVECOH                                       MAIN2350
000      580 IF (CVEG(I,J,K).GT.0.) CVEGV(J,K) = CVEGV(J,K) + CVEG(I,J,K)
000      590 CONTINUE                                                   MAIN2370
000          IF (NFRACT.LE.1) AVEGV(J) = CVEGV(J,NFRELM)                MAIN2380
000      600 CONTINUE                                                   MAIN2390
000
000     C..........STATE VARIABLES FOR SHED SEEDS ARE TOTALLED
000          DO 640 I = 1, NSPECV                                       MAIN2400
000          DO 630 J = 1, NSEEDH                                       MAIN2410
000          DO 603 K = 1, NFRELM
000          IF (SEED(I,J,K).EQ.0.)GO TO 604
000      603 CONTINUE
000          GO TO 608
000      604 DO 605 K = 1, NFRELM
000      605 SEED(I,J,K) = 0.
000      608 DO 620 K = 1, NFRELM
000          A = SEED(I,J,K)                                            MAIN2430
000          IF (A.LE.0.) GO TO 620
000          IF (K.LE.NELEM) GO TO 610                                  MAIN2440
000          ASEED (I,J) = ASEED(I,J) + A                               MAIN2450
000          ASEEDV(J) = ASEEDV(J) + A                                  MAIN2460
000          ASEEDH(I) = ASEEDH(I) + A                                  MAIN2470
000          ASEEDT = ASEEDT + A                                        MAIN2480
000      610 SEEDH(I,K) = SEEDH(I,K) + A                                MAIN2490
000          SEEDVH(K) = SEEDVH(K) + A                                  MAIN2500
000          SEEDV(J,K) = SEEDV(J,K) + A
000      620 CONTINUE
000          IF (NFRACT.GT.0)GO TO 630                                  MAIN2520
000          IF (SEED(I,J,NFRELM).GT.0.) ASEED(I,J) = SEED(I,J,NFRELM)
000          ASEEDV(J) = SEEDV(J,NFRELM)                                MAIN2540
000      630 CONTINUE                                                   MAIN2550
000          IF(NFRACT.GT.0) GO TO 640                                  MAIN2560
000          ASEEDH(I) = SEEDH(I,NFRELM)                                MAIN2570
000      640 CONTINUE                                                   MAIN2580
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000          IF(NFRACT.LE.0) ASEEDT=SEEDV(NFRELM)                            MAIN2590
000          IF(NVCOHR.LE.1) GO TO 700                                        MAIN2600
000
000    C..........PLANT STATE VARIABLES ARE TOTALLED BY STAGES OF DEVELOPMENT
000          I8=0                                                             MAIN2610
000          DO 680 I=1, NSPECV                                               MAIN2620
000          IF(NVCOH(I).LE.1) GO TO 690                                      MAIN2630
000          I8 = I8 + 1                                                      MAIN2640
000          K1 = 1                                                           MAIN2650
000          IF (I.GT.1) K1 = NVCOCU(I-1) + 1                                 MAIN2660
000          K2 = NVCOCU(I)                                                   MAIN2670
000          DO 680 I1 = K1, K2                                               MAIN2680
000          SAVEGO(I8) = SAVEGO(I8) + AVEGO(I1)                              MAIN2690
000          DO 660 J = 1, NORGAN                                             MAIN2700
000          SAVEG(I8, J) = SAVEG(I8, J) + AVEG(I1, J)                        MAIN2710
000          DO 650 K = 1, NFRELM                                             MAIN2720
000      650 IF(CVEG(I1,J,K).GT.0.) SVEG(I8,J,K) = SVEG(I8,J,K) + CVEG(I1,J,K)
000      660 CONTINUE                                                         MAIN2740
000          DO 670 K = 1, NFRELM                                             MAIN2750
000      670 SVEGO(I8,K) = SVEGO(I8,K) + CVEGO(I1,K)                          MAIN2760
000      680 CONTINUE                                                         MAIN2770
000      690 CONTINUE                                                         MAIN2780
000      700 IF (NSPECA.LE.0) GO TO 740                                       MAIN2790
000
000    C..........ANIMAL STATE VARIABLES ARE TOTALLED
000          ABIOMA = 0.                                                      MAIN2800
000          DO 730 I = 1, NSPECA                                             MAIN2810
000          K1=1                                                             MAIN2820
000          IF(I.GT.1)K1 = NCOHCU(I-1)+1                                     MAIN2830
000          K2 = NCOHCU(I)                                                   MAIN2840
000          DO 730 J = K1,K2                                                 MAIN2850
000          IF (POP(J).EQ.0.) GO TO 705
000          DO 704 K = 1, NFRELM
000          IF (CBIOM(J,K).EQ.0.) GO TO 705
000      704 CONTINUE
000          GO TO 707
000      705 DO 706 K = 1, NFRELM
000      706 CBIOM(J,K) = 0.
000          POP(J) = 0.
000      707 ABIOM(J) = 0.
000          DO 720 K = 1, NFRELM                                             MAIN2870
000          A = CBIOM(J,K)                                                   MAIN2880
000          IF (A.LE.0.) GO TO 720
000          IF (K.LE.NELEM) GO TO 710                                        MAIN2890
000          ABIOM(J)  = ABIOM(J) + A                                         MAIN2900
000          ABIOMA = ABIOMA + A                                              MAIN2910
000          ABIOSP(I) = ABIOSP(I) + A                                        MAIN2920
000      710 ANIM(I,K)=ANIM(I,K)+A                                            MAIN2930
000          CBIOMA(K) = CBIOMA(K) + A
000      720 CONTINUE
000          IF ((ABIOM(J).LE.0.).AND.(CBIOM(J,NFRELM).GT.0.))ABIOM(J) =
000         1  CBIOM(J,NFRELM)
000          IF (POP(J).GT.0.) POPSP(I) = POPSP(I) + POP(J)
000      730 CONTINUE                                                         MAIN2970
000          IF (ABIOMA.LE.0.) ABIOMA = CBIOMA(NFRELM)                        MAIN2980
000      740 AGRGH = 0.                                                       MAIN2990
000          DO750 K = 1,NFRELM                                               MAIN3000
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     000         IF (K.GT.NELEM) AORGH= AORGH+ CORGH(K)                              MAIN3010
     000     750 TOT(K) = CORGH(K)+ CLITT(K) + CMINH(K)                              MAIN3020
     000         IF (AORGH.LE.0.) AORGH = CORGH(NFRELM)                              MAIN3030
     000         ATOT = AORGH+ ALITT                                                 MAIN3040
     000
     000   C..........TOTALS FOR THE WHOLE SYSTEM ARE CALCULATED
     000     760 DO 770 K = 1, NFRELM                                                MAIN3050
     000     770 TOTAL(K) = CBIOMA(K) + CVEGVO(K) + SEEDVH(K) + TOT(K)               MAIN3060
     000         ATOTO = ABIOMA + AVEGVO + ASEEDT + ATOT                             MAIN3070
     000         IF (IMIN.GT.0) GO TO 1320                                           MAIN3080
     000         IF (NCHECK.NE.0) GO TO 1340                                         MAIN3090
     000   C-----------------------------------------------------------------------
     000   C     THE DATE IS INITIALIZED
     000   C-----------------------------------------------------------------------
-01  000         IF (MOD(IYR,4).GT.0) GO TO 780                                      MAIN3120
     000         MONDAY(2) = 29                                                      MAIN3130
     000         NYRDAY = 366                                                        MAIN3140
     000     780 IF (JDAY.LE.0) JDAY = 1                                             MAIN3150
     000         IF (NDAY.LE.JDAY) NDAY = JDAY + 1                                   MAIN3160
     000         K = 0                                                               MAIN3170
     000   C-----------------------------------------------------------------------
     000   C     GRAPHING INSTRUCTIONS ARE READ
     000   C-----------------------------------------------------------------------
     000         NOHIS = NOGRAF+1                                                    MAIN3180
     000         NOHISU = NOGRAF + NOHIST                                            MAIN3190
     000     790 IF (NOGRAF.LE.0) GO TO 860                                          MAIN3200
     000
     000   C..........INSTRUCTIONS FOR LINE GRAPHS
     000         DO 850 I = 1, NOGRAF                                                MAIN3210
     000         I1 = K + 1                                                          MAIN3220
     000         READ (5,230) (MGRA(J), J = 1,8)
     000         DO 800 J = 1, 8
     000         IF (MGRA(J).LE.0) GO TO 810
     000         K = K + 1
     000         LIGRAF(K) = MGRA(J)
     000     800 CONTINUE                                                            MAIN3280
     000     810 LISTER(I) = K                                                       MAIN3290
     000         READ (5,250) (TITLES(I,J) , J = 1,20)                               MAIN3300
     000         READ (5,250) (YAXISS(I,J),J=1,10), ORIGIN(I)                        MAIN3310
     000         IF (K.LE.I1) GO TO 830                                              MAIN3320
     000         DO 820 J = I1,K                                                     MAIN3330
     000     820 READ (5,250) (EXPLAN(L,J), L = 1,5)                                 MAIN3340
     000         GO TO 850                                                           MAIN3350
     000     830 DO 840 J = 1,5                                                      MAIN3360
     000     840 EXPLAN(J,I1) = BLANK                                                MAIN3370
     000     850 CONTINUE                                                            MAIN3380
     000     860 IF (NOHIST.LE.0) GO TO 890                                          MAIN3390
     000
     000   C..........INSTRUCTIONS FOR BLOCK GRAPHS
     000         K1 = K + 1                                                          MAIN3400
     000         K2 = K + NOHIST                                                     MAIN3410
     000         READ (5,230) (LIGRAF(I), I = K1, K2)                                MAIN3420
     000         DO 870 I = NOHIS,NOHISU                                             MAIN3430
     000         READ (5,250) (TITLES(I,J), J = 1, 20)                               MAIN3440
     000     870 READ (5,250) (YAXISS(I,J),J=1,10), ORIGIN(I)                        MAIN3450
     000     880 FORMAT (' ',20A4)                                                   MAIN3460
     000   C-----------------------------------------------------------------------
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        000   C     SPECIFICATIONS OF TABULAR OUTPUT ARE INITIALIZED
        000   C-----------------------------------------------------------------
        000     990 J = 0                                                          MAIN3520
        000         DO 910 I = 1, NREP                                             MAIN3530
        000         IF ((MREP(I).LE.0).OR.(MREP(I).GT.NDAY)) GO TO 910             MAIN3540
        000         IF((I.GT.1).AND.(MREP(I).LE.MREP(I-1)))GO TO 910               MAIN3550
        000         J = J + 1                                                      MAIN3560
        000         MREP(J) = MREP(I)                                              MAIN3570
        000     910 CONTINUE                                                       MAIN3580
        000         NREP = J                                                       MAIN3590
        000         IF (J.EQ.0) GO TO 920                                          MAIN3600
        000         IF (MREP(J).EQ.NDAY) GO TO 930                                 MAIN3610
        000     920 NREP = NREP + 1                                                MAIN3620
        000         MREP(NREP) = NDAY                                              MAIN3630
        000     930 IREP = 1                                                       MAIN3640
        000         IF (NOHISU.LE.0) GO TO 940                                     MAIN3650
        000         XMIN = JDAY                                                    MAIN3660
        000         XMAX = NDAY                                                    MAIN3670
        000         PERIOD = (XMAX - XMIN)/69.                                     MAIN3680
        000     940 IDAY=JDAY                                                      MAIN3690
        000         IYRDAY = IDAY                                                  MAIN3700
        000   C-----------------------------------------------------------------
        000   C     PROCESS SUBROUTINES ARE CALLED TO PERMIT PARAMETERS TO BE READ
        000   C-----------------------------------------------------------------
        000         CALL VINPUT                                                    MAIN3710
        000         CALL AINPUT                                                    MAIN3720
        000         CALL SINPUT                                                    MAIN3730
        000   C-----------------------------------------------------------------
        000   C     IF REQUIRED, PART OF THE COMMON BLOCK /PARAM/ IS PRINTED OUT.
        000   C-----------------------------------------------------------------
        000         IF (IPARAM.LE.0) GO TO 947
        000         WRITE (6,943) IPARAM, JPARAM
        000     943 FORMAT('0COMMON BLOCK /PARAM/ FROM ADDRESS', I6,' TO ADDRESS',I6/)
        000         WRITE (6,945) (P(I), I = IPARAM, JPARAM)
        000     945 FORMAT (1X, 10G12.5)
        000     947 IRUN = 1
        000         IF (ISENSE.EQ.0) GO TO 960                                     MAIN3750
        000   C-----------------------------------------------------------------
        000   C     IF SENSITIVITY TESTS ARE BEING PERFORMED, THE SUBROUTINE SENSIT
        000   C     IS CALLED TO SET THE INITIAL CONDITIONS
        000   C-----------------------------------------------------------------
        000         CALL SENSIT(IRUN)                                              MAIN3760
        000     950 IF(IRUN.EQ.1) GO TO 960                                        MAIN3770
        000         IDAYPR = JDAY - 1
        000         FRAC = 0.
        000         IMIN = 0
        000         IREP = 1                                                       MAIN3780
        000         CALL SENSIT(IRUN)                                              MAIN3790
    NEW 000         IYR = INITYR
        000         IDAY = JDAY                                                    MAIN3800
        000         IYRDAY = JDAY                                                  MAIN3810
        000         NCHECK = 0                                                     MAIN3820
        000     960 CONTINUE                                                       MAIN3830
        000         NSHORT = 0
        000         LOOPER = -1
        000         DO 965 I = 1, LIMACC
        000         SING(I) = 0.
```

```
000      965 CHNG(I) = 0.
000          IF (NOHISU.LE.0) GO TO 980                                     MAIN3840
000      C-----------------------------------------------------------------------
000      C   LIMITS FOR THE GRAPHS ARE INITIALIZED
000      C-----------------------------------------------------------------------
000          DO 970 I = 1, NOHISU                                           MAIN3850
000          AMINI(I) = HIGH                                                MAIN3860
000      970 AMAXI(I) = -HIGH                                               MAIN3870
000      980 FRAC = 0.
000      C-----------------------------------------------------------------------
000      C   THE CALENDAR MONTH IS DETERMINED
000      C-----------------------------------------------------------------------
000          MONEND = 0                                                     MAIN3900
000          MONTH = 0                                                      MAIN3910
000          NUMMON = JDAY                                                  MAIN3920
000      990 MONTH = MONTH + 1                                              MAIN3930
000          MONEND = MONEND + MONDAY(MONTH)                                MAIN3940
000          IF (MONTH.GT.1) NUMMON = NUMMON - MONDAY(MONTH-1)              MAIN3950
000          IF ( IYRDAY.GT.MONEND) GO TO 990                               MAIN3960
000      C-----------------------------------------------------------------------
000      C   THE SUBROUTINE EXOGEN IS CALLED TO RECEIVE INPUT OF
000      C   EXOGENOUS VARIABLES
000      C-----------------------------------------------------------------------
000          CALL EXOGEN                                                    MAIN3980
000          IF (NOPEP.GE.2) GO TO 1020
000      C-----------------------------------------------------------------------
000      C   A HEADING IS PRINTED FOR THE INITIAL REPORT
000      C-----------------------------------------------------------------------
000          WRITE(6,1000)  (PLACE(I),I=1,20)                               MAIN4000
000     1000 FORMAT ('1', 20A4)                                             MAIN4010
000          WRITE (6,1010) DECJAN(MONTH), NUMMON, IYR                      MAIN4020
000     1010 FORMAT('0INITIAL REPORT ON ', A4, I3, I5)                      MAIN4030
000      C-----------------------------------------------------------------------
000      C   PLANT COVER IS CALCULATED
000      C-----------------------------------------------------------------------
000          CALL KOVER                                                     MAIN4040
000     1020 IF (NOHISU.LE.0) GO TO 1140                                    MAIN4050
000      C-----------------------------------------------------------------------
000      C   THE GRAF SUBROUTINE IS SUPPLIED WITH CURRENT VALUES FOR THE
000      C   VARIABLES TO BE GRAPHED
000      C-----------------------------------------------------------------------
000          I2 = 0                                                         MAIN4060
000          IF (NOGRAF.LE.0) GO TO 1080                                    MAIN4070
000          DO 1070 I = 1, NOGRAF                                          MAIN4080
000          I1 = I2 + 1                                                    MAIN4090
000          I2 = LISTER(I)                                                 MAIN4100
000          DO 1070 J =I1, I2                                              MAIN4110
000          I3 = LIGRAF(J)                                                 MAIN4120
000          I4 = I3/10000                                                  MAIN4130
000          I3 = I3 - I4*10000                                             MAIN4140
000          I4 = I4 + 1                                                    MAIN4150
000          GO TO (1050,1030,1040,1055), I4
000     1030 A =SUMS(I3)                                                    MAIN4170
000          GO TO 1060                                                     MAIN4180
000     1040 A = STNG(I3)                                                   MAIN4190
000          GO TO 1060                                                     MAIN4200
000     1050 A = STATE (I3)                                                 MAIN4210
```

```
000        GO TO 1060
000   1055 A = PEST(I3)
000   1060 AMINI(I) = AMIN1(AMINI(I),A)                           MAIN4220
000        AMAXI(I) = AMAX1(AMAXI(I),A)                           MAIN4230
000   1070 FIGS (J,1) = A                                         MAIN4240
000   1080 IF (NOHIST.LE.0) GO TO 1490                            MAIN4250
000        I1= LISTER(NOGRAF)                                     MAIN4260
000        I2 = I1 + NOHIST                                       MAIN4270
000        I1 = I1 + 1                                            MAIN4280
000        I = NOGRAF                                             MAIN4290
000        DO 1130 J =I1, I2                                      MAIN4300
000        I = I + 1                                              MAIN4310
000        I3 = LIGRAF(J)                                         MAIN4320
000        I4 = I3/10000                                          MAIN4330
000        I3 = I3 - I4*10000                                     MAIN4340
000        I4 = I4 + 1                                            MAIN4350
000        GO TO(1110,1090,1100,1115), I4
000   1090 A = SUMS(I3)                                           MAIN4370
000        GO TO 1120                                             MAIN4380
000   1100 A = STNG(I3)                                           MAIN4390
000        GO TO 1120                                             MAIN4400
000   1110 A = STATE(I3)                                          MAIN4410
000        GO TO 1120
000   1115 A =  PEST(I3)
000   1120 AMINI(I) = A                                           MAIN4420
000        AMAXI(I) = A                                           MAIN4430
000   1130 FIGS(J,1) = A                                          MAIN4440
000   1140 IF (NOREP.GE.2) GO TO 1150                             MAIN4450
000        GO TO 1490                                             MAIN4460
000   1150 IF (NOSECS.LE.1) GO TO 1160                            MAIN4470
000   C------------------------------------------------------------------
000   C      THE CPU TIMER IS REPORTED AND RE-SET
000   C------------------------------------------------------------------
000        TIMER = EXTIME(0)                                      MAIN4480
000        WRITE (6,1220) TIMER                                   MAIN4490
000   C------------------------------------------------------------------
000   C      THE FOLLOWING SECTION ACTUALLY PERFORMS THE SIMULATION OVER A
000   C      SINGLE TIME UNIT
000   C------------------------------------------------------------------
000
000   C..........THE LIMITS FOR THE TIME UNIT OF SIMULATION ARE SET AND THE
000   C..........TIME-UNIT LOOP IS INITIALIZED
000   1160 ORIG = FLOAT(IDAY) + FRAC                              MAIN4500
000        FRAC = AMOD((UNIT + FRAC), 1.)
000        IDAY1 = IDAY                                           MAIN4510
000        FINDAY = ORIG + UNIT - .00001
000        IDAY2 = ORIG + UNIT                                    MAIN4520
000        IYRDAZ = IYRDAY                                        MAIN4530
000        MONTHZ = MONTH                                         MAIN4540
000        NUMMOZ = NUMMON                                        MAIN4550
000        MONENZ = MONEND                                        MAIN4560
000        NYRDAZ = NYRDAY                                        MAIN4570
000        IYRZ = IYR                                             MAIN4580
000        LOOP = 0                                               MAIN4590
000        FACTO = 1.                                             MAIN4600
000        FACTOR = 0.                                            MAIN4610
000        LOOPER = -1
```

```
C..........INITIALIZATION FOR THE CURRENT REPETITION OF THE TIME-UNIT
C..........LOOP IS PERFORMED
 1170 VEGCO = 0.                                                       MAIN4620
      SOTLCO= 0.                                                       MAIN4630
      ANTMCO= 0.                                                       MAIN4640
      FACTOR = FACTO                                                   MAIN4650
      IDAY = ORIG                                                      MAIN4660
      LOOP = LOOP + 1                                                  MAIN4670
      IF (LOOP.GT.1) LOOPER = 1
      IF (LOOP.LE.20) GO TO 1190                                       MAIN4680
      WRITE (6,1180) IDAY                                              MAIN4690
 1180 FORMAT (' TIME LOOP ATTEMPTED TWENTY TIMES  AT DAY', I4)         MAIN4700
      STOP                                                             MAIN4710
 1190 IMIN = 0                                                         MAIN4720
      IYRDAY = IYRDAZ                                                  MAIN4740
      MONTH = MONTHZ                                                   MAIN4750
      NUMMON = NUMMOZ                                                  MAIN4760
      MONEND = MONENZ                                                  MAIN4770
      NYRDAY = NYRDAZ                                                  MAIN4780
      IYR = IYRZ                                                       MAIN4790
      DO 1280 IDAY = IDAY1, IDAY2                                      MAIN4800
      IF (IDAY.LE.IDAY1) GO TO 1210
      NUMMON = NUMMON + 1                                              MAIN4820
      IYRDAY = IYRDAY + 1                                              MAIN4830
      IF (IYRDAY.LE.NYRDAY) GO TO 1200                                 MAIN4840
      MONTH = 1                                                        MAIN4850
      MONEND = MONDAY(1)                                               MAIN4860
      IYRDAY = IYRDAY - NYRDAY                                         MAIN4870
      NUMMON = IYRDAY                                                  MAIN4880
      IYR = IYR + 1                                                    MAIN4890
      NYRDAY = 365                                                     MAIN4900
      MONDAY(2) = 28                                                   MAIN4910
      IF (MOD(IYR,4).GT.0) GO TO 1200
      MONDAY(2) = 29                                                   MAIN4930
      NYRDAY = 366
 1200 IF (IYRDAY.LE.MONEND) GO TO 1210                                 MAIN4950
      NUMMON = IYRDAY - MONEND
      MONTH = MONTH + 1                                                MAIN4970
      MONEND = MONEND + MONDAY(MONTH)                                  MAIN4980
      IF (FLOAT(IDAY).GE.FINDAY) GO TO 1280

C..........THE SUBROUTINE EXOGEN IS CALLED FOR CURRENT VALUES OF
C..........THE EXOGENOUS VARIABLES
 1210 CALL EXOGE2
      LOOPER = 0
 1220 FORMAT ( 104X, F10.3, ' SECONDS ELAPSED')                        MAIN5000
      IF ((LOOP.GT.1).OR.(IDAY.LE.IDAYPR)) GO TO 1230
      PRECMM = PRECMM + DARAIN + DASNOW
      IDAYPR = IDAY
 1230 DAYDAY = AMIN1 (UNIT, FLOAT(IDAY-IDAY1+1))                       MAIN5020

C..........THE PROCESS SUBROUTINES ARE CALLED AS FREQUENTLY
C..........AS NECESSARY WITHIN EACH DAY OF THE TIME UNIT.
      IF (NSPECV.LE.0) GO TO 1250                                      MAIN5030
 1240 IF ((VEGCO + VEGINC).GT.DAYDAY) GO TO 1250                       MAIN5040
      VEGCO = VEGCO + VEGINC                                           MAIN5050
```

```
      CALL VEGET
      GO TO 1240
 1250 IF (NSPECA.LE.0) GO TO 1270
 1260 IF ((ANIMCO + ANIINC).GT.DAYDAY) GO TO 1270
      ANIMCO = ANIMCO + ANIINC
      CALL ANIMAL
      GO TO   1260
 1270 IF((SOILCO + SOIINC).GT.DAYDAY)  GO TO 1280
      SOILCO = SOILCO + SOIINC
      CALL SOILS
      GO TO 1270
 1280 NCHECK = 1

C..........PROPOSED DECREMENTS ARE TESTED TO ENSURE THAT STATE
C..........VARIABLES ARE ADEQUATE TO MEET THEM.  OTHERWISE, THE
C..........TIME UNIT IS REDUCED
      DO 1290 I = 1, LIMIT
      IF (DECINC(I).GE.0.) GO TO 1290
      IF((DECINC(I)+STATE(I)).GE.0.)GO TO 1290
      IF (STATE(I).GT.0.) GO TO 1287
      IDAY = ORIC
      WRITE (6,1283) I, DECINC(I), IDAY
 1283 FORMAT (' STATE(',I4,') IS ZERO, SO PROPOSED DECREMENT OF',E15.8,
     1' PER TIME STEP AT DAY', I5,' IS IMPOSSIBLE')
      NDAY = IDAY
      NSHORT = 1
      GO TO 1460
 1287 A = -STATE(I)/DECINC(I)
      IF (A.GE.FACTOR) GO TO 1290
      FACTOR = A
      IMIN = I
 1290 CONTINUE

C..........INCREMENTS ARE APPLIED, TO THE STATE VARIABLES AND
C..........ACCUMULATORS, AND THE INCREMENT ARRAYS ARE RE-INITIALIZED
      DO 1300 I = 1, LIMIT
      A = DECINC(I)
      IF (A.EQ.0.) GO TO 1300
      IF (STATE(I).LT.0.) A = AMIN1(0.,-A)
      IF (FACTOR.LT.1.) A = A * FACTOR
      STATE(I) = STATE(I) + A
      IF (ABS(STATE(I)).LT.AMICRO) STATE(I) = 0.
      DECINC(I) = 0.
 1300 CONTINUE
      DO 1310 I = 1, LIMACC
      STNG (I) = STNG(I) + CHNG(I) * FACTOR
 1310 CHNG(I) = 0.
      IF (IMIN) 420,420,428

C..........IF ANY STATE VARIABLES HAVE BEEN INADEQUATE TO MEET
C..........THE PROPOSED DECREMENTS, THE TIME-UNIT LOOP IS RE-ENTERED
 1320 FACTO = FACTO - FACTOR
      STATE(IMIN) = - AMICRO
      NEGATE(LOOP) = IMIN
      WRITE (6,1330) IMIN, FACTOR, IDAY, FRAC
 1330 FORMAT(' STATE(',I5,') PERMITS ONLY',F13.10,' OF THE PROPOSED UNIT
     1 CHANGE AT',I4,' + ',F5.3,' DAYS')
```

```
000        GO TO 1170                                                   MAIN5410
000   1340 IDAY = IDAY2                                                 MAIN5440
000        IF (IDAY.LE.IDAY1) GO TO 1150                                MAIN5460
000        IF (NOHISU.LE.0) GO TO 1450                                  MAIN5470
000   C-----------------------------------------------------------------------
000   C    IF GRAPHS ARE REQUIRED, THE CURRENT VALUES OF VARIABLES
000   C    FOR GRAPHING ARE RECORDED
000   C-----------------------------------------------------------------------
000        JX = (FRAC + FLOAT(IDAY-JDAY))/PERIOD + 1.                   MAIN5480
000        IF (IDAY.EQ.NDAY) JX = 70                                    MAIN5490
000        IF (JX.EQ.JXXX) GO TO 1450                                   MAIN5500
000        JXXX = JX                                                    MAIN5510
000        I2 = 0                                                       MAIN5520
000        I = 0                                                        MAIN5530
000   1360 I = I + 1                                                    MAIN5540
000        IF (I.GT.NOHISU) GO TO 1440                                  MAIN5550
000        I1 = I2 + 1                                                  MAIN5560
000        I2 = I1                                                      MAIN5570
000        IF (I.LE.NOGRAF) I2 = LISTER(I)                              MAIN5580
000        DO 1430 J = I1, I2                                           MAIN5590
000        I3 = LIGRAF(J)                                               MAIN5600
000        I4 = I3/10000                                                MAIN5610
000        I3 = I3 - I4*10000                                           MAIN5620
000        I4 = I4 + 1                                                  MAIN5630
000        GO TO (1390,1370,1380,1395), I4
000   1370 A =SUMS(I3)                                                  MAIN5650
000        GO TO 1400                                                   MAIN5660
000   1380 A = STNG(I3)                                                 MAIN5670
000        GO TO 1400                                                   MAIN5680
000   1390 A = STATE (I3)                                               MAIN5690
000        GO TO 1400
000   1395 A = REST(I3)
000   1400 FIGS(J,JX) = A                                               MAIN5700
000        IF (JX.LE.JY) GO TO 1420                                     MAIN5710
000        JX1 = JX - 1                                                 MAIN5720
000        ADD = (     A      - FIGS(J,JY-1))/FLOAT(JX - JY + 1)        MAIN5730
000        BADD = FIGS(J,JY-1)                                          MAIN5740
000        DO 1410 K = JY, JX1                                          MAIN5750
000        BADD = BADD + ADD                                            MAIN5760
000   1410 FIGS(J,K) =                BADD                              MAIN5770
000   1420 CONTINUE                                                     MAIN5780
000        AMAXI(I) = AMAX1(AMAXI(I), A)                                MAIN5790
000   1430 AMINI(I) = AMIN1(AMINI(I), A)                                MAIN5800
000        GO TO 1360                                                   MAIN5810
000   1440 JY = JX + 1                                                  MAIN5820
000   1450 IF (MDEBUG.LE.0) GO TO 1455
000        NDEBUG = 0
000        IF ((IDAY.GE.MDEBUG).AND.(IDAY.LE.LDEBUG)) NDEBUG = 1
000   C-----------------------------------------------------------------------
000   C    STATE VARIABLES MAY BE DUMPED ON LOGICAL UNITS 10 ETC. IF NEEDED.
000   C-----------------------------------------------------------------------
000   1455 IF (KDUMP.LE.0) GO TO 1458
000        IF (IDUMP(JDUMP).GT.IDAY) GO TO 1458
000        REWIND IOUNIT
000        WRITE (IOUNIT) STATE
000        END FILE IOUNIT
000        WRITE (6,1456) IDAY, IOUNIT
```

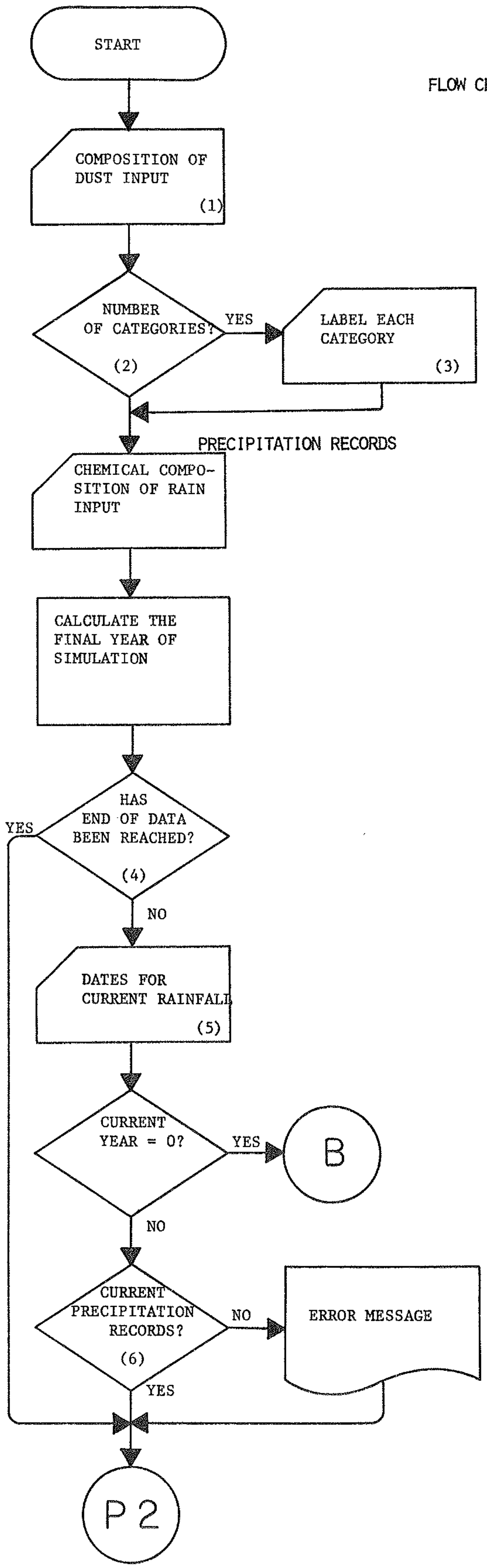
```
000   1456 FORMAT ('1STATE VARIABLES DUMPED AT DAY', I5,' ON UNIT', I3)
000        JDUMP = JDUMP + 1
000        IF (JDUMP.GT.KDUMP) KDUMP = 0
000        IOUNIT = IOUNIT + 1
000   1458 IF (ISENSE.EQ.0) GO TO 1460
000   C-----------------------------------------------------------------------
000   C     IF SENSITIVITY TESTS ARE TO BE PERFORMED, THE CURRENT VALUES
000   C     OF THE VARIABLES REQUIRED ARE RECORDED
000   C-----------------------------------------------------------------------
000        ISW = 1                                                      MAIN5840
000        CALL SENOUT (ISW,IDAY,IRUN)                                  MAIN5850
000   1460 IF ((IDAY.LT.MFFP(IREP)).AND.(IDAY.LT.NDAY)) GO TO 1150      MAIN5860
000   C-----------------------------------------------------------------------
000   C     IF A TABULAR REPORT IS REQUIRED AT THIS STAGE OF THE
000   C     SIMULATION, IT IS PRODUCED.
000   C-----------------------------------------------------------------------
000        IF ((NOREP.EQ.1).OR.(NOREP.EQ.2)) GO TO 1510                 MAIN5870
000        WRITE (6,1000) (PLACE(I), I=1,20)                            MAIN5880
000        KDAY = IDAY - JDAY                                           MAIN5890
000        IF (NSHORT.EQ.0) GO TO 1467
000        WRITE (6,1463) KDAY, DECJAN(MONTH), NUMMON, IYR
000   1463 FORMAT(' REPORT WHEN SIMULATION ENDED AFTER',I5,' DAYS, I.E. JUST
000       1PRIOR TO ',A4, I3, I5)
000        GO TO 1490
000   1467 WRITE(6,1470)IREP,DECJAN(MONTH),NUMMON,IYR,KDAY
000   1470 FORMAT ('0REPORT NO.', I3, ' ON ', A4, I3, I5,' (I.E., AFTER',I4,
000       1' DAYS OF SIMULATION)')
000        IF (FRAC.GT.0.0005) WRITE (6,1480) FRAC                      MAIN5930
000   1480 FORMAT ('+', 60X, ' + ', F5.3, ' DAY')
000        IREP = IREP + 1                                              MAIN5950
000   1490 CALL REPORT                                                  MAIN5960
000        IF(NCHECK.GT.0)WRITE(6,1495)DECJAN(MONTH),NUMMON,IYR,PRECMM,PRECMM
000   1495 FORMAT('0ACCUMULATED PRECIPITATION TO ',A4,I3,I5,' INCLUSIVE IS',
000       1 F7.1,' MM. - THAT IS ',1PF8.1,' TONS PER HECTARE')
000        IF (NOSECS.LE.0) GO TO 1510                                  MAIN5970
000   C-----------------------------------------------------------------------
000   C     THE CPU TIMER IS REPORTED AND RE-SET, AND
000   C     THE SIMULATION IS CONTINUED UNLESS COMPLETE
000   C-----------------------------------------------------------------------
000   1500 FORMAT    ('+',103X,F10.3,' SECONDS ELAPSED')                MAIN5980
000        TIMER= EXTIME(0)                                             MAIN5990
000        WRITE (6,1500) TIMER                                         MAIN6000
000   1510 IF (IDAY.LT.NDAY) GO TO 1150                                 MAIN6010
000   C-----------------------------------------------------------------------
000   C     IF SIMULATION IS COMPLETE, ANY GRAPHS REQUIRED ARE PRINTED
000   C-----------------------------------------------------------------------
000        I2 = 0                                                       MAIN6020
000        IF (NOGRAF.LE.0) GO TO 1600                                  MAIN6030
000
000   C..........LINE GRAPHS
000        DO 1590 I = 1, NOGRAF                                        MAIN6040
000        I1 = I2 + 1                                                  MAIN6050
000        I2 = LISTER(I)                                               MAIN6060
000        I3 = 0                                                       MAIN6070
000        DO 1560 K = I1, I2                                           MAIN6080
000        I3 = I3 + 1                                                  MAIN6090
000        DO 1520 J = 1,5                                              MAIN6100
```

```
 1520 EYPLA(J,I3) = EXPLAN(J,K)
      YMAX = AMAXI(I)
      YMIN = AMINI(I)
      IF((ORIGIN(I).NE.ZERO).OR.((YMAX.GT.0.).AND.(YMIN.LT.0.)))GO TO
     1 1550
      IF (YMAX) 1530,1550,1540
 1530 YMAX = 0.
      GO TO 1550
 1540 YMIN = 0.
 1550 DO 1560 J = 1, 70
 1560 FIG(I3,J) = FIGS(K,J)
      DO 1570 J = 1, 20
 1570 TITLE(J) = TITLES(I,J)
      DO 1580 J = 1, 10
 1580 YTITLE(J) = YAXISS(I,J)
      NOSYM = I3
      CALL GRAF
      IF (NOSECS.LE.0) GO TO 1590
      TIMER=  EXTIME(Q)
      WRITE(6,1500)TIMER
 1590 CONTINUE
 1600 IF (NOHISU.LE.NOGRAF) GO TO 1690

C..........BLOCK GRAPHS
      I1 = I2 + NOHIST
      I2 = I2 + 1
      K = NOGRAF
 1610 DO 1680 I = I2, I1
      K = K + 1
      YMAX = AMAXI(K)
      YMIN = AMINI(K)
      IF((ORIGIN(I).NE.ZERO).OR.((YMAX.GT.0.).AND.(YMIN.LT.0.)))GO TO
     1 1640
      IF (YMAX) 1620,1640,1630
 1620 YMAX = 0.
      GO TO 1640
 1630 YMIN = 0.
 1640 DO 1650 J = 1, 70
 1650 XDOT(J) = FIGS(I,J)
      DO1660 J = 1, 20
 1660 TITLE(J) = TITLES(K,J)
      DO 1670 J = 1,10
 1670 YTITLE(J) = YAXISS(K,J)
      CALL HIST
C-----------------------------------------------------------------------
C     THE CPU TIMER IS REPORTED AND RE-SET
C-----------------------------------------------------------------------
      TIMER= EXTIME(Q)
      WRITE (6,1500) TIMER
 1680 CONTINUE
 1690 CONTINUE
      IF (ISENSE.EQ.0) STOP
C-----------------------------------------------------------------------
C     IF SENSITIVITY TESTS ARE REQUIRED, THE SUBROUTINE SENOUT
C     IS CALLED TO RECORD FINAL VALUES OF THE VARIABLES, AND, IF THE
C     LAST RUN HAS BEEN COMPLETED, TO PRINT OUT THE RESULTS.
C-----------------------------------------------------------------------
```

```
001367      000          ISW = 0                                              MAIN6580
001368      000          CALL SENOUT (ISW,IDAY,IRUN)                          MAIN6590
001369      000          IRUN = IRUN + 1                                      MAIN6600
001370      000          IF (IRUN.LE.30) GO TO 950                            MAIN6610
001371      000          STOP                                                 MAIN6620
001372      000          END                                                  MAIN6630
```

FLOW CHART OF EXOGEN



(1) QUANTITY AND CHEMICAL COMPOSITION OF DUST INPUT.

(2) THE NUMBER OF CATEGORIES OF DEAD MATERIAL TRANSPORTED BY WATER >0?

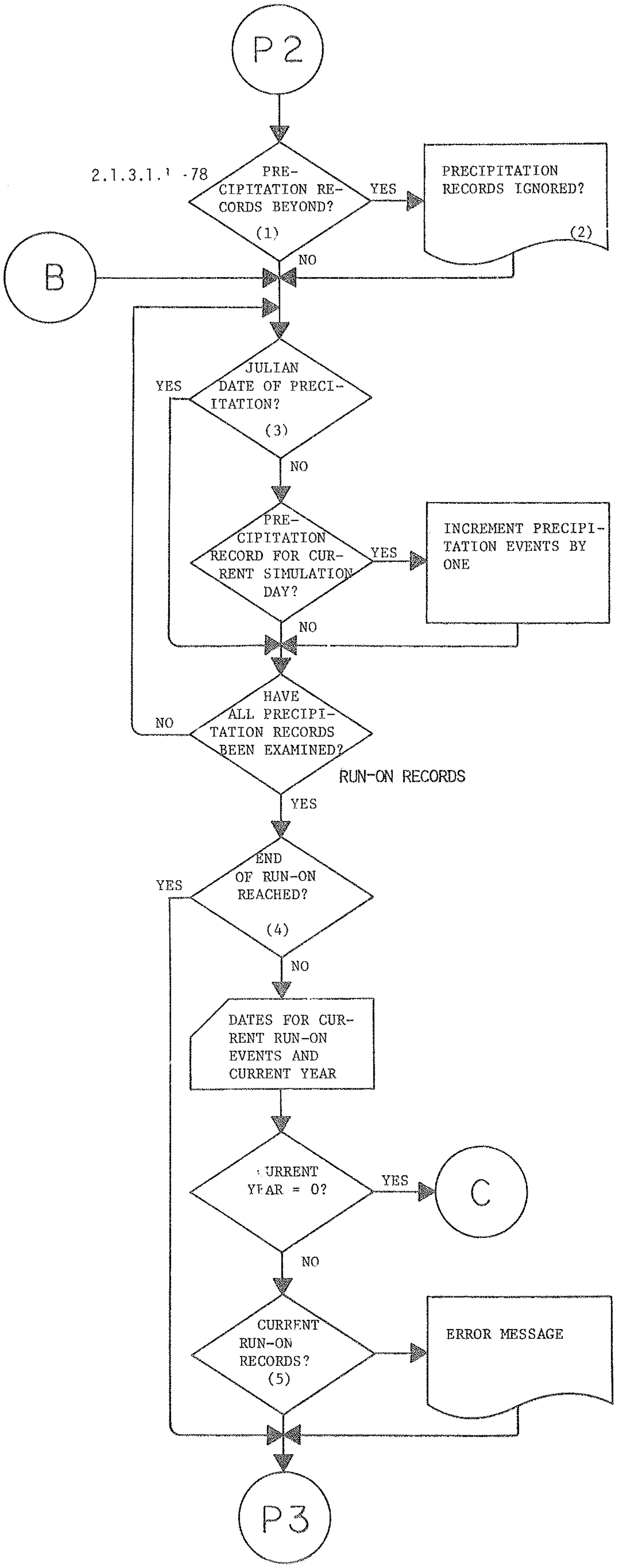
(3) INTEGRAL LABEL OF EACH CATEGORY OF DEAD MATERIAL TRANSPORTED.

(4) HAS THE END OF THE RELEVENT DATA BEEN RECORDED?

(5) DATES FOR CURRENT RAINFALL EVENTS AND CURRENT YEAR.

(6) IS THE CURRENT PRECIPITATION RECORD IN PROPER ORDER FOR THE CURRENT YEAR AND IS CURRENT YEAR DURING SPECIFIED TIME OF SIMULATION?

2.1.3.1.¹ -78



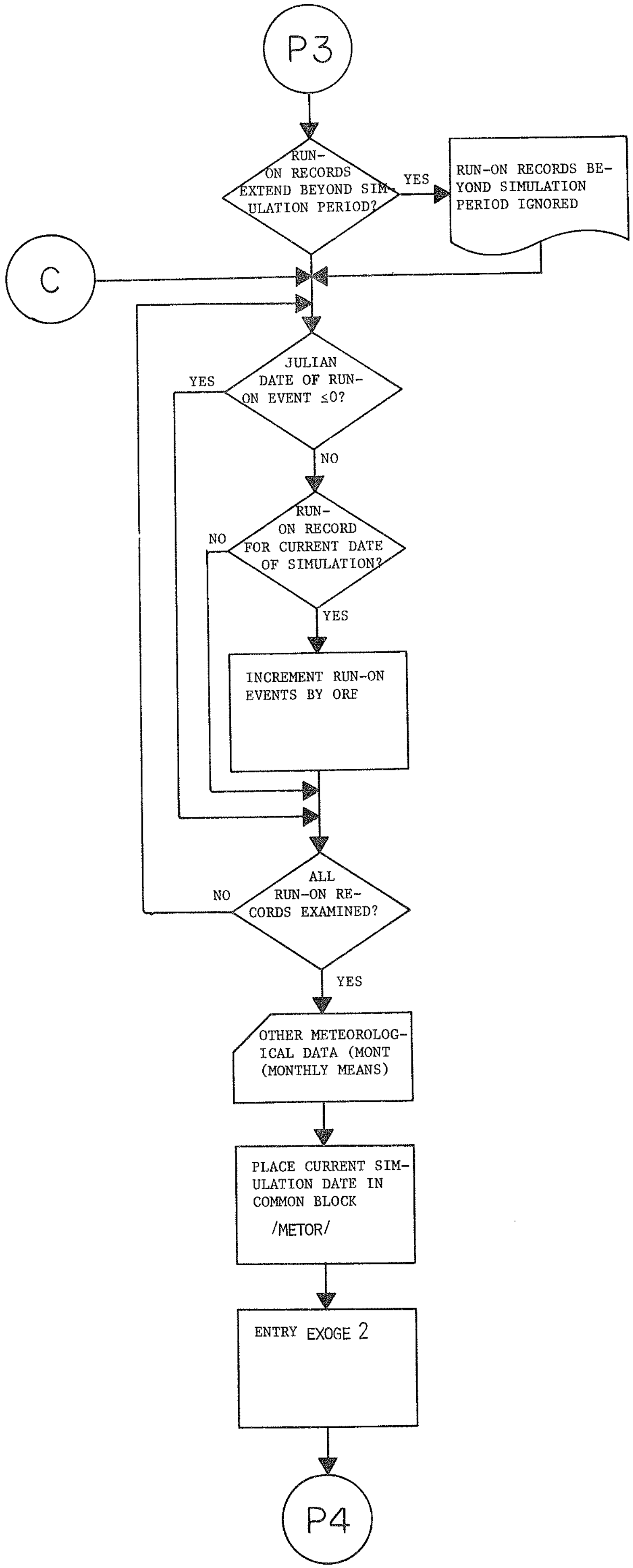
(1) PRECIPITATION RECORDS EXTEND BEYOND SIMULATION PERIOD?

(2) PRECIPITATION RECORDS BEYOND SIMULATION TIME IGNORED.

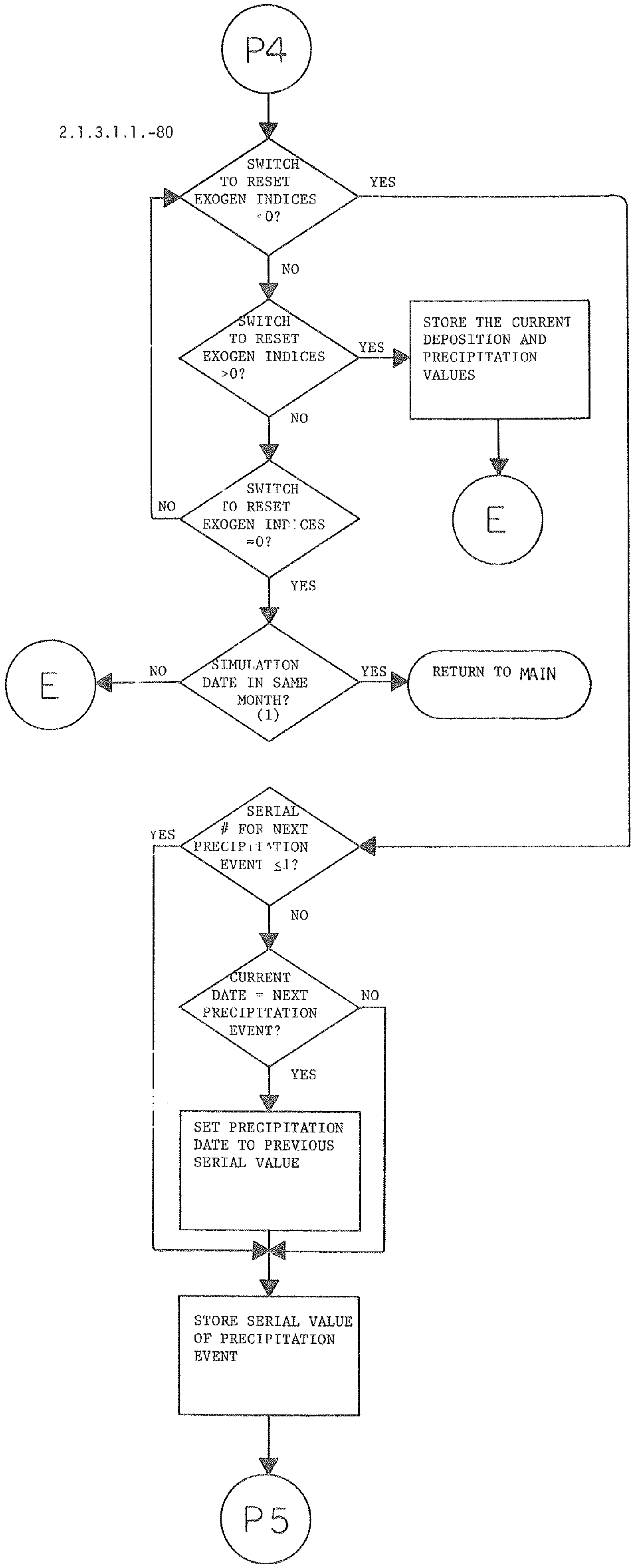
(3) JULIAN DATE OF PRECIPITATION EVENT ≤0?

(4) HAS THE END OF THE RELEVANT RUN-ON RECORDS BEEN REACHED?

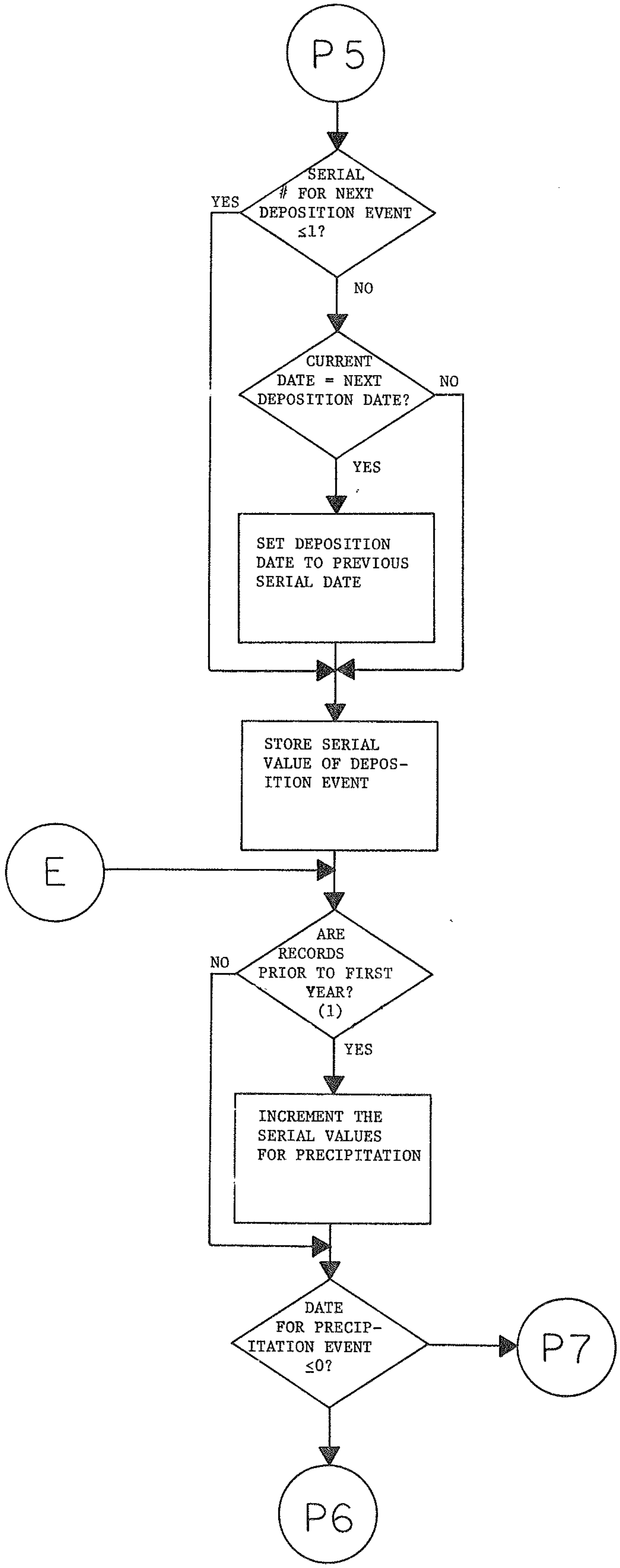
(5) ARE THE CURRENT RUN-ON RECORDS IN PROPER ORDER AND FOR CURRENT YEAR DURING SPECIFIED TIME OF SIMULATION?


P3
RUN-ON RECORDS EXTEND BEYOND SIMULATION PERIOD?
YES
RUN-ON RECORDS BEYOND SIMULATION PERIOD IGNORED
C
JULIAN DATE OF RUN-ON EVENT ≤0?
YES
NO
RUN-ON RECORD FOR CURRENT DATE OF SIMULATION?
NO
YES
INCREMENT RUN-ON EVENTS BY ORE
ALL RUN-ON RECORDS EXAMINED?
NO
YES
OTHER METEOROLOGICAL DATA (MONT (MONTHLY MEANS)
PLACE CURRENT SIMULATION DATE IN COMMON BLOCK /METOR/
ENTRY EXOGE 2
P4

2.1.3.1.1.-80

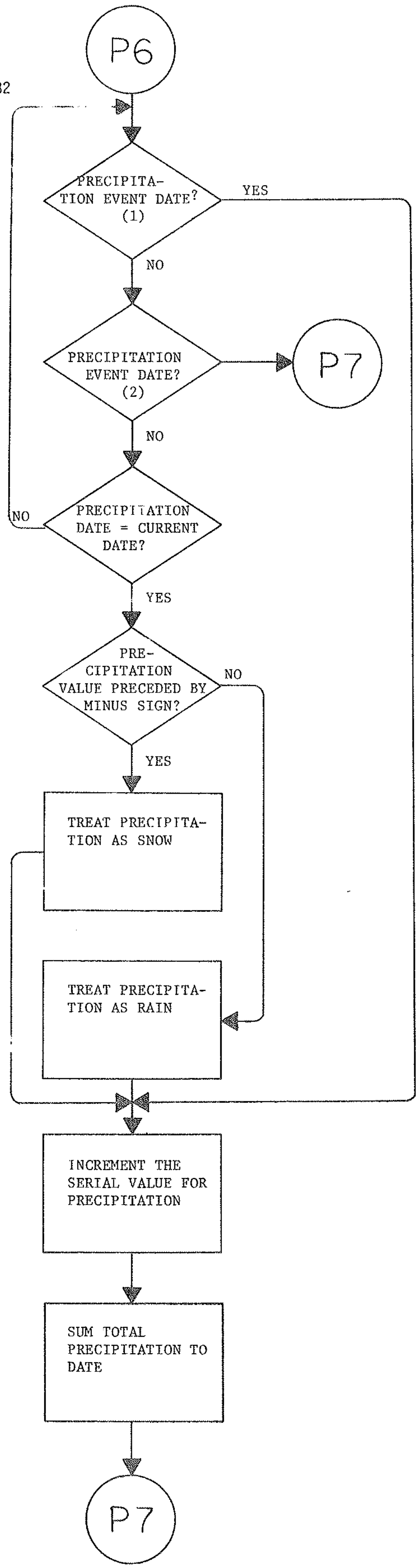


(1) CURRENT SIMULATION DATE IN SAME MONTH AS PREVIOUS SIMULATION DATE?



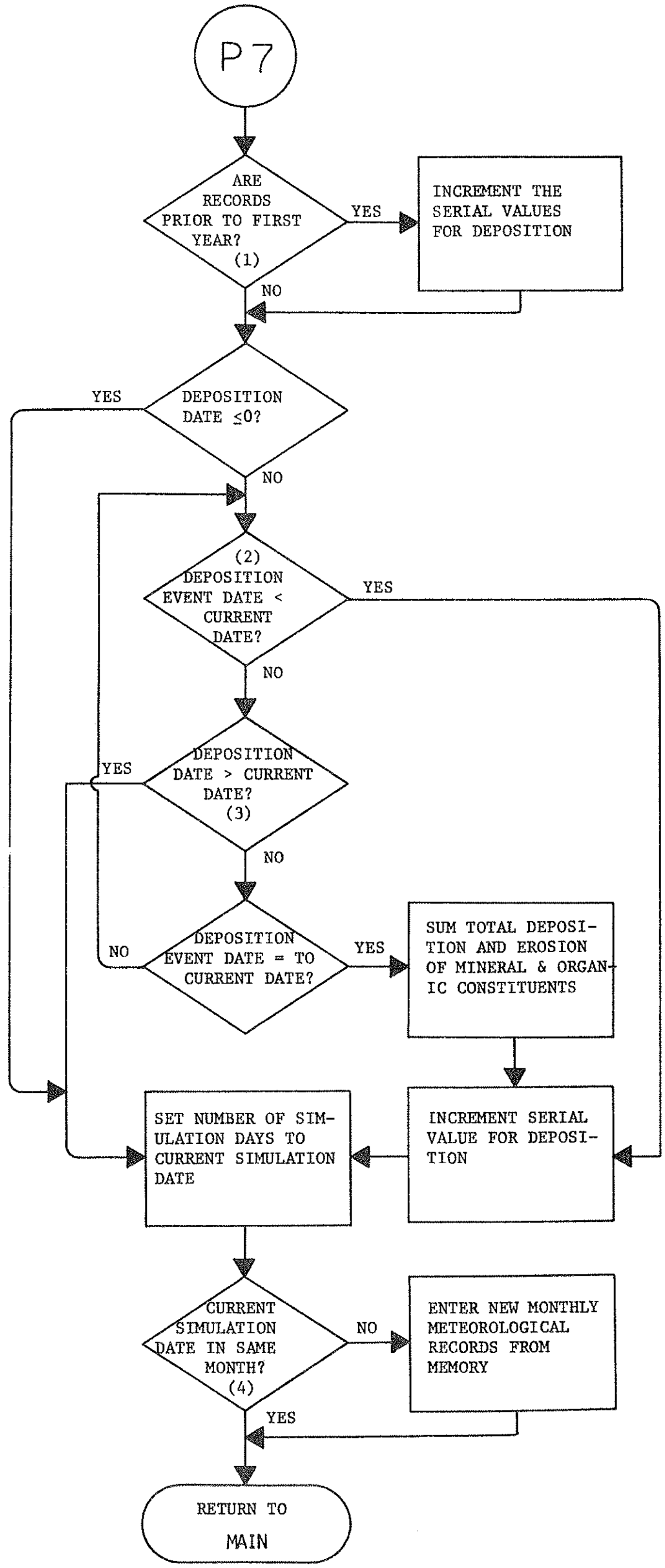
(1) ARE THESE PRECIPITATION RECORDS PRIOR TO THE FIRST YEAR OF SIMULATION?

2.1 3.1.1.-82



(1) PRECIPITATION EVENT DATE < CURRENT SIMULATION DATE?

(2) PRECIPITATION EVENT DATE > CURRENT SIMULATION DATE?



(1) ARE THESE DEPOSITION RECORDS PRIOR TO THE FIRST YEAR OF SIMULATION?

(2) DEPOSITION EVENT DATE < CURRENT SIMULATION DATE?

(3) DEPOSITION EVENT DATE > CURRENT SIMULATION DATE?

(4) CURRENT SIMULATION DATE IN SAME MONTH AS PREVIOUS SIMULATION DATE?

EXOGEN

PROGRAM LISTING

```
000
000   C THIS SUBROUTINE ORGANIZES INPUT AND STORAGE OF EXOGENOUS VARIABLES,
000   C AND PROVIDES THE APPROPRIATE CURRENT VALUES TO OTHER SUBROUTINES
000   C THROUGH THE COMMON BLOCK /METEOR/.
000
000   C THE FOLLOWING ARE DEFINITIONS OF VARIABLES NOT IN BLOCKS COMMON TO
000   C THE MAIN PROGRAM.    THOSE USED FOR TEMPORARY STORAGE ONLY ARE
000   C OMITTED.
000   C
000   C DAPHOT           THE PHOTOPERIOD IN HOURS FOR THE CURRENT DAY
000   C DAYRAD           THE TOTAL RADIATION IN CAL/SQ.CM/DAY FOR THE
000   C                  CURRENT DAY
000   C DARAIN           THE AMOUNT OF PRECIPITATION IN MM ON THE CURRENT DAY
000   C DASNOW           SNOWFALL FOR THE CURRENT DAY (IN MM. PRECIPITATION)
000   C DAYRUN           THE ACCUMULATED AMOUNT OF RUN-ON (G. PER HECTARE)
000   C DAYWVP           THE WATER VAPOR PRESSURE ON THE CURRENT DAY
000   C DRUNMI (K)       THE AMOUNT OF THE K'TH MINERAL ELEMENT IN THE IMPORTED
000   C                  SOIL MATERIAL ENTERING THE ECOSYSTEM IN THE CURRENT
000   C                  DEPOSITION EVENT
000   C DRUNLT (L,K)     THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000   C                  L'TH CATEGORY OF DEAD MATERIAL MOVED INTO THE
000   C                  ECOSYSTEM IN THE CURRENT DEPOSITION EVENT
000   C DRUNOR (K)       THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT IN THE
000   C                  ORGANIC MATTER ENTERING THE ECOSYSTEM IN THE
000   C                  CURRENT DEPOSITION EVENT
000   C DUSCOM (K)       THE CONCENTRATION (IN G PER G) OF THE K'TH CHEMICAL
000   C                  CONSTITUENT IN DUST BLOWN INTO THE ECOSYSTEM
000   C DUST             THE TOTAL WEIGHT OF DUST BLOWN INTO THE ECOSYSTEM PER
000   C                  DAY
000   C DWINAV           THE AVERAGE WIND SPEED ON THE CURRENT DAY
000   C DWINMX           THE MAXIMUM WIND SPEED ON THE CURRENT DAY
000   C ERODE            THE ACCUMULATED AMOUNT OF INERT SOIL MATERIAL IN
000   C                  DEPOSITED MATERIAL
000   C ERODED(I)        SOIL IMPORTED (G.PER HECTARE) IN THE I'TH DEPOSITION
000   C                  EVENT
000   C EVAPOR(J)        MEAN DAILY POTENTIAL EVAPOTRANSPIRATION (MM.) IN THE
000   C                  J'TH MONTH
000   C EXO(K)           ARRAY EQUIVALENCED WITH THE COMMON BLOCK /METEOR/
000   C IRAIN            THE SERIAL NUMBER OF THE NEXT PRECIPITATION EVENT
000   C IIRUN            HAS THE SAME MEANING AS IRUN IN THE MEAN PROGRAM, FOR
000   C                  PURPOSES OF SENSITIVITY TESTS
000   C IRUN             THE SERIAL NUMBER OF THE NEXT DEPOSITION EVENT
000   C JIRAIN           STORAGE OF IRAIN FOR SENSITIVITY TESTS
000   C JIRUN            STORAGE OF IRUN  FOR SENSITIVITY TESTS
000   C JKDAY            STORAGE OF KDAY FOR SENSITIVITY TESTS
000   C JKYR             STORAGE OF KYR  FOR SENSITIVITY TESTS
000   C KDAY             VALUE OF IYRDAY WHEN SUBROUTINE WAS LAST CALLED
000   C KYR              VALUE OF IYR WHEN SUBROUTINE WAS LAST CALLED
000   C LIMEXI           ADDRESS OF FIRST ENTRY IN COMMON BLOCK METEOR
000   C                  ('ERODE') REQUIRING REINITIALIZATION EVERY DAY
000   C LIMEXO           SIZE OF ARRAY EXO
000   C LIMRUN           MAXIMUM NUMBER OF DEPOSITION EVENTS THAT CAN BE
000   C                  INCLUDED
000   C LIRAIN           MAXIMUM NUMBER OF PRECIPITATION EVENTS THAT CAN BE
000   C                  INCLUDED
```

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000   C MONOLD          THE MONTH WHEN EXOGE2 WAS LAST CALLED
000   C MRAIN(L)        DATE (FROM JAN 1) OF THE L'TH PRECIPITATION EVENT
000   C MRUNON(I)       DATE (FROM JAN.1) OF THE I'TH DEPOSITION EVENT
000   C NRAIN           NUMBER OF PRECIPITATION EVENTS DURING THE PERIOD OF
000   C                 SIMULATION
000   C NRUNLT          NUMBER OF CATEGORIES OF DEAD MATERIAL WHICH CAN BE
000   C                 TRANSPORTED DURING DEPOSITION EVENTS
000   C NRUNON          NUMBER OF DEPOSITION EVENTS DURING THE PERIOD OF
000   C                 SIMULATION
000   C PHOTOP(J)       MEAN PHOTOPERIOD (HRS) IN THE J'TH MONTH
000   C RADIA(J)        MEAN DAILY RADIATION (CAL./SQ.CM./DAY) IN THE J'TH
000   C                 MONTH
000   C RAIN(L)         PRECIPITATION (MM) IN THE L'TH PRECIPITATION EVENT
000   C RAINCO (K)      THE AMOUNT OF THE K'TH CHEMICAL CONSTITUENT
000   C                 PRESENT IN PRECIPITATION
000   C RUNLIT(I,N,P)   AMOUNT (G. PER HECTARE) OF THE P'TH CONSTITUENT IN THE
000   C                 N'TH CATEGORY OF DEAD MATERIAL IMPORTED IN THE I'TH
000   C                 DEPOSITION EVENT
000   C RUNMIN(I,P)     AMOUNT (G. PER HECTARE) OF THE P'TH CONSTITUENT
000   C                 IMPORTED IN INORGANIC FORM DURING THE I'TH
000   C                 DEPOSITION EVENT
000   C RUNON(I)        AMOUNT (G.PER HECTARE) OF WATER IMPORTED IN THE I'TH
000   C                 DEPOSITION EVENT
000   C RUNORG(I,P)     AMOUNT(G. PER HECTARE) OF THE P'TH CONSTITUENT
000   C                 IMPORTED IN SOIL ORGANIC MATTER IN THE I'TH
000   C                 DEPOSITION EVENT
000   C TDAY            THE MEAN DAYTIME TEMPERATURE FOR THE CURRENT DAY
000   C TEMDAY(J)       MEAN DAY TEMPERATURE IN THE J'TH MONTH (DEGREES
000   C                 CELSIUS)
000   C TEMNIT(J)       MEAN NIGHT TEMPERATURE IN THE J'TH MONTH (DEGREES
000   C                 CELSIUS)
000   C TNIGHT          THE MEAN NIGHT-TIME TEMPERATURE FOR THE CURRENT DAY
000   C WINDAV(J)       MEAN WIND VELOCITY IN THE J'TH MONTH (KM. PER HR.)
000   C WINDMX(J)       MEAN DAILY MAXIUMU WIND VELOCITY IN THE J'TH MONTH
000   C                 (KM. PER HR.)
000   C WVP(J)          MEAN WATER VAPOR PRESSURE IN THE J'TH MONTH (MM.HG)
000
000         SUBROUTINE EXOGEN                                              EXOG0010
000         DIMENSION MRAIN(200),RAIN(200),MRUNON(50),RUNON(50),           EXOG0020
000        1 ERODED(50),RUNMIN(50,6),RUNORG(50,6),TEMDAY(12),TEMNIT(12),   EXOG0030
000        2 EVAPOR(12),PHOTOP(12),RADIA(12),WVP(12),WINDAV(12),WINDMX(12) FXOG0040
000        3 ,EXO(67), RUNLIT(50,5,6), MTEMP(15)
000   C-------------------------------------------------------------------------
000   C     COMMON BLOCK /SPEC/ CONTAINS SPECIFICATIONS AND OTHER INFORMATION
000   C     COMMON TO THE WHOLE SET OF PROGRAMS, BUT EXCLUDING STATE AND
000   C     EXOGENOUS VARIABLES.
000   C-------------------------------------------------------------------------
000         COMMON/SPEC/NCHAN,INSTRU(20),         NSPECV,NSPECA,NORGAN,NFRACT,
000        1 NDAY,NFLEM,NOLIT,NCHECK,IDAY,IYRDAY,NREPET(20),NDEBUG,NHORIZ
000        2,NCOH(10),LISCOH(30),NCOHCU(10),NCOHOR,NFRELM,NFRAC1,NSPCOH,MONTH,
000        3 HORDEP(6),LITRUN(5),MREP(20),IYR,DRYFAV(3,6),LITCAT(15)
000        4,NVECOH,LISVCO(15),NVCOH(10),NVCOCU(10),NOSECS,IIRUN,NRUNLT
000        5,ISTD,JSTD,ILIT,JLIT,ILH,JLH,SEEDEP(6),NSEEDH,NELEMS,JSTATE,JDAY
000        6,LOOPER
000   C-------------------------------------------------------------------------
000   C     COMMON BLOCK /METEOR/ CONTAINS THE VALUES OF EXOGENOUS VARIABLES
000   C     FOR THE CURRENT TIME UNIT.
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000   C------------------------------------------------------------------------
000         COMMON/METEOR/EVAP,TDAY,TNIGHT,DAYWVP,DWINAV,DWINMX,DAPHOT,
000        1 DAYRAD,DUST,DUSCOM(6),RAINCO(6),ERODE,DAYRUN,DRUNMI(6),DRUNOR(6) FXOG0140
000        2 ,DRUNLT(5,6), DASNOW, DARAIN
000         EQUIVALENCE (EXO,EVAP)                                            EXOG0160
000         DATA LIMEX1/23/, LIMEXO/67/, LIRAIN/200/, LIMRUN/50/
000         DATA MRAIN/200*0/, MRUNON/50*0/                                   EXOG0180
000      10 FORMAT (16I5)                                                     EXOG0190
000      20 FORMAT (8F10.2)                                                   EXOG0200
000         MONOLD = 0.                                                       EXOG0210
000         IF(IIRUN.LE.1)     GO TO 25
000         IRAIN = JIRAIN
000         IRUN = JIRUN
000         IYRUN = JIYRUN
000         IYRAIN = JIYRAN
000         KDAY = JKDAY
000         KYR = JKYR
000         GO TO 485
000   C------------------------------------------------------------------------
000   C     INITIAL DATA ARE READ IN
000   C------------------------------------------------------------------------
000
000   C..........DUST QUANTITY AND COMPOSITION
000      25 READ (5,20) DUST
000         READ (5,20)(DUSCOM(K),K=1,NELEM)                                  EXOG0230
000
000   C..........A LIST OF CATEGORIES OF DEAD ORGANIC MATERIAL WHICH CAN BE
000   C..........IMPORTED DURING DEPOSITION EVENTS IS READ IN.
000         READ (5,10) NRUNLT                                                FXOG0240
000         IF (NRUNLT.GT.0) READ (5,10) (LITRUN(I), I=1,NRUNLT)              EXOG0250
000
000   C..........PRECIPITATION RECORDS
000         READ (5,20) (RAINCO(K), K=1,NELEM)                                EXOG0260
000         NYR = NDAY/366 + IYR                                              EXOG0270
000         KYR = IYR                                                         EXOG0280
000         I2 = 0                                                            EXOG0290
000         INDEX = 0                                                         EXOG0300
000      30 IF (INDEX.GT.0) GO TO 160                                         EXOG0310
000         READ (5,40) (MTEMP(I), I = 1,15), JYR                             EXOG0320
000      40 FORMAT (15I5, 1X, I4)                                             EXOG0330
000         IF (JYR.EQ.0) GO TO 190                                           EXOG0340
000         IF ((JYR.GE.IYR).AND.(JYR.LE.NYR)) GO TO 60                       EXOG0350
000      50 READ (5,410) LYR                                                  EXOG0360
000         IF (JYR.NE.LYR) GO TO 70                                          FXOG0370
000         GO TO 30                                                          EXOG0380
000      60 IF (JYR - KYR) 70,100,90                                          FXOG0390
000      70 WRITE (6,80)                                                      EXOG0400
000      80 FORMAT ('0PRECIPITATION RECORDS OUT OF ORDER')                    EXOG0410
000         GO TO 160                                                         EXOG0420
000      90 KYR = KYR + 1                                                     EXOG0430
000         I2 = I2 + 1                                                       FXOG0440
000         GO TO 60                                                          EXOG0450
000     100 DO 110 I = 1, 15                                                  EXOG0460
000         I3 = 16 - I                                                       EXOG0470
000         IF (MTEMP(I3).GT.0) GO TO 120                                     FXOG0480
000     110 CONTINUE                                                          EXOG0490
000         GO TO 50                                                          FXOG0500
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000    120 I1 = I2                                                     EXOG0510
000        I2 = I1 + I3                                                EXOG0520
000        I1 = I1 + 1                                                 EXOG0530
000        IF (I2.LE.LIRAIN) GO TO 130                                 EXOG0540
000        I3 = I3 - I2 + LIRAIN                                       EXOG0550
000        I2 = LIRAIN                                                 EXOG0560
000        INDEX = 1                                                   EXOG0570
000    130 I4 = I1 - 1                                                 EXOG0580
000        DO 140 I = 1, I3                                            EXOG0590
000        I5 = I + I4                                                 EXOG0600
000    140 MRAIN(I5) = MTEMP(I)                                        EXOG0610
000        I9 = I1 + 14                                                EXOG0620
000        READ (5,150) (RAIN(I), I = I1, I9), LYR                     EXOG0630
000    150 FORMAT (15F5.1, 1X, I4)                                     EXOG0640
000        IF (LYR.EQ.JYR) GO TO 30                                    EXOG0650
000        GO TO 70                                                    EXOG0660
000    160 READ (5,410) J                                              EXOG0670
000        IF (J.GT.0) GO TO 160                                       EXOG0680
000    170 WRITE (6,180) JYR                                           EXOG0690
000    180 FORMAT ('0PRECIPITATION RECORDS FROM', I5,' ON IGNORED')    EXOG0700
000        I2 = I1 - 1                                                 EXOG0710
000    190 NRAIN = I2                                                  EXOG0720
000        IYRAIN = IYR                                                EXOG0730
000        DO 210 IRAIN = 1, NRAIN                                     EXOG0740
000        IF (MRAIN(IRAIN).LE.0) GO TO 220                            EXOG0750
000    200 IF(IDAY.LE.MRAIN(IRAIN)) GO TO 220                          EXOG0760
000    210 CONTINUE                                                    EXOG0770
000        IRAIN = NRAIN + 1                                           EXOG0780
000    220 KYR = IYR                                                   EXOG0790
000        I2 = 0                                                      EXOG0800
000        INDEX = 0                                                   EXOG0810
000
000   C..........RECORDS OF DEPOSITION EVENTS
000    230 IF (INDEX.GT.0) GO TO 400                                   EXOG0820
000        READ (5,40) (MTEMP(I), I = 1, 15), JYR                      EXOG0830
000        IF (JYR.LE.0) GO TO 440                                     EXOG0840
000        IF ((JYR.GE.IYR).AND.(JYR.LE.NYR)) GO TO 260                EXOG0850
000    240 I3 = NELEM + NFRELM + NRUNLT*NFRELM + 2                     EXOG0860
000        DO 250 I = 1, I3                                            EXOG0870
000        READ (5,410) LYR                                            EXOG0880
000        IF (LYR.NE.JYR) GO TO 270                                   EXOG0890
000    250 CONTINUE                                                    EXOG0900
000        GO TO 230                                                   EXOG0910
000    260 IF (JYR - KYR) 270, 310, 300                                EXOG0920
000    270 WRITE (6, 280)                                              EXOG0930
000    280 FORMAT ('0RECOPDS OF DEPOSITION EVENTS OUT OF ORDER')
000        WRITE (6,290) IYR,JYR,LYR,NYR,I,I3                          EXOG0950
000    290  FORMAT (' IYR, JYR, LYR, NYR, I, I3 ARE', 6I5)             EXOG0960
000        GO TO 400                                                   EXOG0970
000    300 KYR = KYR + 1                                               EXOG0980
000        I2 = I2 + 1                                                 EXOG0990
000        GO TO 260                                                   EXOG1000
000    310 DO 320 I = 1, 15                                            EXOG1010
000        I3 = 16 - I                                                 EXOG1020
000        IF (MTEMP(I3).GT.0) GO TO 330                               EXOG1030
000    320 CONTINUE                                                    EXOG1040
000        GO TO 240                                                   EXOG1050
```

```
  330 I1 = I2
      I2 = I1 + I3
      I1 = I1 + 1
      IF (I2.LE.LIMRUN)    GO TO 340
      I3 = I3 - I2 + LIMRUN
      I2 = LIMRUN
      INDEX = 1
  340 I4 = I1 - 1
      DO 350 I = 1, I3
      I5 = I + I4
  350 MRUNON(I5) = MTEMP(I)
      I9 = I1 + 14
      READ (5,150) (RUNON(I), I = I1, I9), LYR
      IF (LYR.NE.JYR) GO TO 390
      READ (5,150)(EPODED(I), I = I1, I9), LYR
      IF (LYP.NE.JYR) GO TO 390
      DO 360 K = 1, NELEM
      READ (5,150) (RUNMIN(  I,K), I = I1, I9), LYR
      IF (LYR.NE.JYR) GO TO 390
  360 CONTINUE
      DO 370 K = 1, NFRELM
      READ (5,150) (RUNORG(  I,K), I = I1, I9), LYR
      IF (LYR.NE.JYR) GO TO 390
  370 CONTINUE
      IF (NRUNLT.LE.0) GO TO 230
      DO 380 J = 1, NRUNLT
      DO 380 K = 1, NFRELM
      READ (5,150) (RUNLIT(I,J,K), I = I1, I9), LYR
      IF (LYR.NE.JYR) GO TO 390
  380 CONTINUE
      GO TO 230
  390 CONTINUE
  400 READ (5,410) J
  410 FORMAT (76X, I4)
      IF (J.GT.0) GO TO 400
  420 WRITE (6,430) JYR
  430 FORMAT ('0RECORDS OF DEPOSITION EVENTS FROM',I5,' ON IGNORED')
      I2 = I1 - 1
  440 NRUNON = I2
      IYRUN = IYR
  450 DO 470 IRUN = 1, NRUNON
      IF (MRUNON(IRUN).LE.0) GO TO 480
  460 IF (IDAY.LT.MRUNON(IRUN)) GO TO 480
  470 CONTINUE
      IRUN = NRUNON + 1

C..........OTHER METEOROLOGICAL RECORDS (MONTHLY MEANS)
  480 READ (5,20) (TEMDAY(I), I=1,12)
      READ (5,20) (TEMNIT(I), I=1,12)
      READ (5,20) (EVAPOR(I), I=1,12)
      READ (5,20) (PHOTOP(I), I=1,12)
      READ (5,20) (RADIA (I), I=1,12)
      READ (5,20) (WVP   (I), I=1,12)
      READ (5,20) (WINDAV(I), I=1,12)
      READ (5,20) (WINDMX(I), I=1,12)
      KYR = IYR
      KDAY=IDAY-1
```

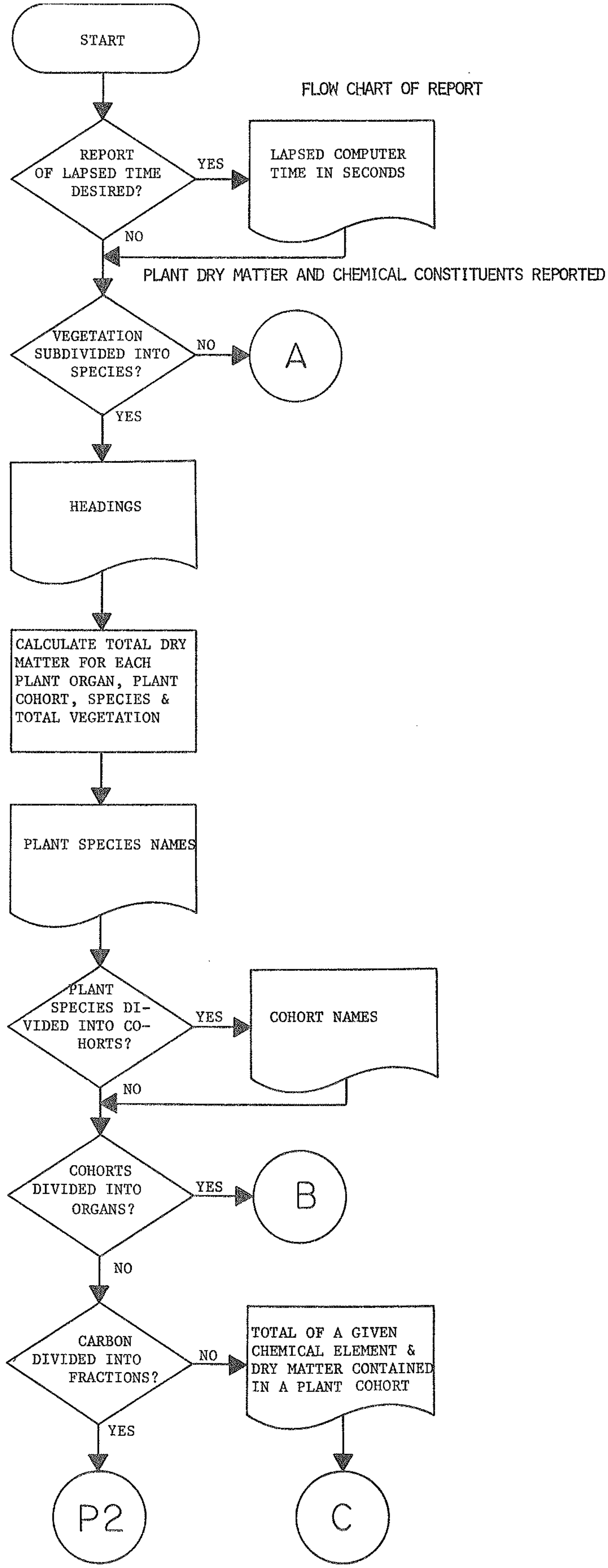
```
         000          JIRAIN = IRAIN
         000          JIRUN = IRUN
         000          JIYRUN = IYRUN
         000          JIYRAN = IYRAIN
         000          JKDAY = KDAY
         000          JKYR = KYR
         000          ENTRY EXOGE2                                                   EXOG1610
         000      485 CONTINUE
         000
         000    C..........THE INDICES FOR RAIN AND DEPO^SITION EVENTS ARE STORED OP
         000    C..........RE-INITIALIZED
         000          IF (LOOPER) 487,489,488
NEW      000      487 IF (IRAIN.LE.1) GO TO 511
-01      000          IF (IYRDAY.EQ.MRAIN(IRAIN-1)) IRAIN = IRAIN - 1
         000      511 KRAIN : IRAIN
         000          IF (IRUN.LE.1) GO TO 512
         000          IF (IYRDAY.EQ.MRUNON(IRUN-1)) IRUN = IRUN - 1
         000      512 KRUN = IRUN
         000          GO TO 491
         000      488 IRAIN = KRAIN
         000          IRUN = KRUN
         000    C-----------------------------------------------------------------------
         000    C     DATA FOR THE CURRENT DAY ARE EXTRACTED AND PLACED IN THE /METFOR/
         000    C     COMMON BLOCK.
         000    C-----------------------------------------------------------------------
         000          GO TO 491
         000      489 IF (KDAY.EQ.IYRDAY) RETURN
         000      491 DO 490 I = LIMEX1, LIMEXO
         000      490 EXO(I) = 0.                                                    EXOG1640
         000
         000    C..........PRECIPITATION
         000          IF (KYR.GE.IYR) GO TO 560
         000          IRAIN = IRAIN + 1
         000      560 IF (MRAIN(IRAIN).LE.0) GO TO 620
         000      580 IF (MRAIN(IRAIN)- IYRDAY) 610, 590, 620
         000      590 A = RAIN(IRAIN)                                                EXOG1890
         000
         000    C..........WHETHER RAIN OR SNOW
         000          IF (A.GE.0.) GO TO 600                                         EXOG1900
         000          A = -A                                                         FXOG1910
         000          DASNOW = A + DASNOW                                            EXOG1920
         000          GO TO 610
         000      600 DARAIN = A + DARAIN                                            EXOG1930
         000      610 IRAIN = IRAIN + 1                                              FXOG1940
         000
         000    C..........DEPOSITION EVENTS
NFW      000      620 IF(KYR.GE.IYR) GO TO 585
-01      000          IRUN = IRUN + 1
         000      585 IF (MRUNON(IRUN).LE.0) GO TO 740
         000          IF (MRUNON(IRUN) - IYRDAY) 730, 690, 740
         000      690 DAYRUN = RUNON(IRUN) + DAYRUN                                  EXOG2080
         000          ERODE = ERODED(IRUN) + ERODE                                   EXOG2090
         000          DO 700 K = 1, NELEM                                            EXOG2100
         000      700 DRUNMI(K) = RUNMIN(IRUN,K) + DRUNMI(K)                         EXOG2110
         000          DO 710 K = 1, NFRELM                                           EXOG2120
         000      710 DRUNOR(K)  =RUNORG(IRUN,K) + DRUNOR(K)                         EXOG2130
         000          DO 720 J=1,NRUNLT                                              EXOG2140
```

```
000         DO 720 K=1 ,NFPELM                                    EXOG2150
000     720 DRUNLT(J,K) = PUNLIT (IRUN,J,K) + DRUNLT(J,K)         EXOG2160
000     730 IRUN = IRUN + 1                                       EXOG2170
000     740 KDAY = IYRDAY                                         EXOG2180
000         KYR = IYR                                             EXOG2190
000         IF (MONTH.EQ.MONOLD) RETURN                           EXOG2200
000
000   C..........OTHER METEOROLOGICAL RECORDS
000         TDAY = TEMDAY(MONTH)                                  EXOG2210
000         TNIGHT = TEMNIT(MONTH)                                EXOG2220
000         EVAP = EVAPOP(MONTH)                                  EXOG2230
000         DAYWVP= WVP(MONTH)                                    EXOG2240
000         DWINAV = WINDAV(MONTH)                                EXOG2250
000         DWINMX = WINDMX(MONTH)                                EXOG2260
000         DAYRAD = RADIA(MONTH)                                 EXOG2270
000         DAPHOT = PHOTOP(MONTH)                                EXOG2280
000         MONOLD = MONTH                                        EXOG2290
000         RETURN                                                EXOG2300
000         END                                                   EXOG2310
```

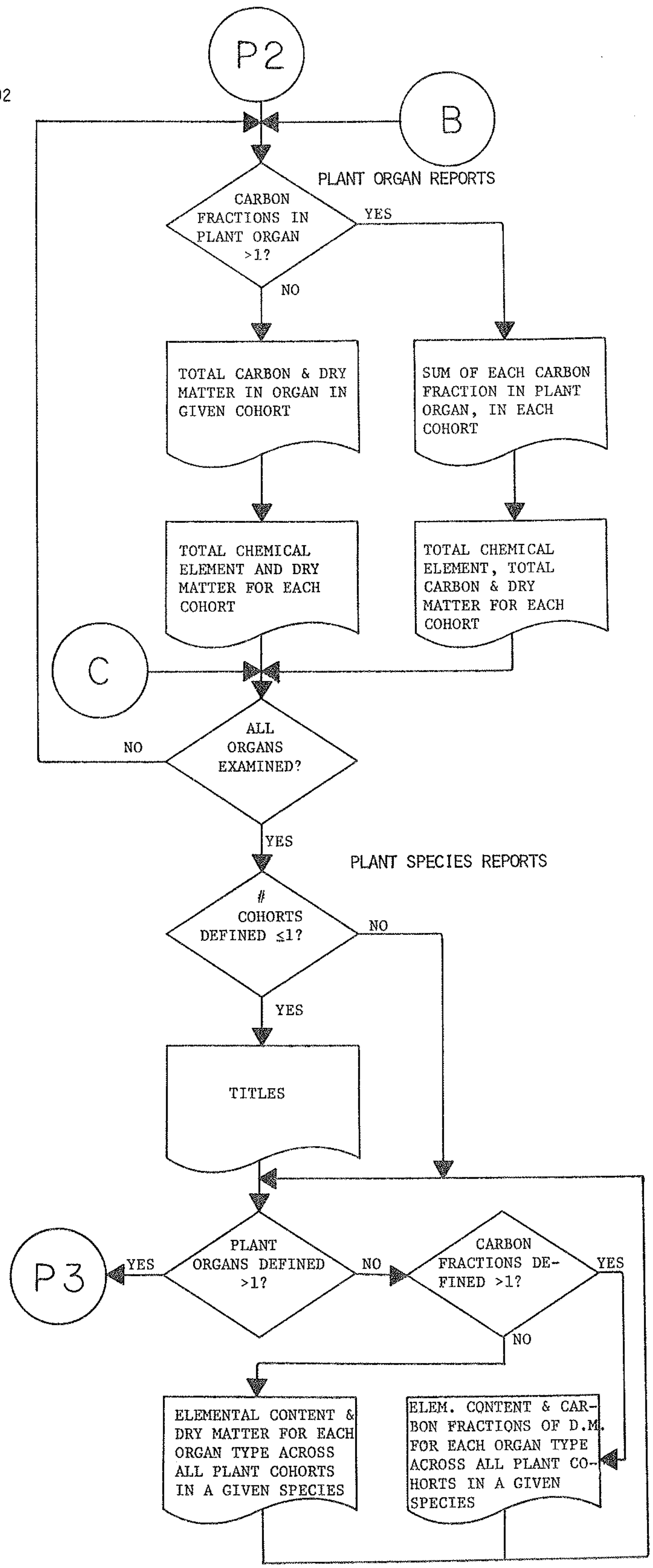
```
          000       JIRAIN = IRAIN
          000       JIRUN = IRUN
          000       JIYRUN = IYRUN
          000       JIYRAN = IYRAIN
          000       JKDAY = KDAY
          000       JKYR = KYR
          000       ENTRY EXOGE2                                                   EXOG1610
          000   485 CONTINUE
          000
          000 C..........THE INDICES FOR RAIN AND DEPOCITION EVENTS ARE STORED OP
          000 C..........RE-INITIALIZED
          000       IF (LOOPER) 487,489,488
    NEW   000   487 IF (IRAIN.LE.1) GO TO 511
    -01   000       IF (IYRDAY.EQ.MRAIN(IRAIN-1)) IRAIN = IRAIN - 1
          000   511 KRAIN = IRAIN
          000       IF (IRUN.LE.1) GO TO 512
          000       IF (IYRDAY.EQ.MRUNON(IRUN-1)) IRUN = IRUN - 1
          000   512 KRUN = IRUN
          000       GO TO 491
          000   488 IRAIN = KRAIN
          000       IRUN = KRUN
          000 C-----------------------------------------------------------------------
          000 C     DATA FOR THE CUPRENT DAY ARE EXTRACTED AND PLACED IN THE /METFOR/
          000 C     COMMON BLOCK.
          000 C-----------------------------------------------------------------------
          000       GO TO 491
          000   489 IF (KDAY.EQ.IYRDAY) RETURN
          000   491 DO 490 I = LIMEX1, LIMEXO
          000   490 EXO(I) = 0.                                                    EXOG1640
          000
          000 C..........PRECIPITATION
          000       IF (KYR.GE.IYR) GO TO 560
          000       IRAIN = IRAIN + 1
          000   560 IF (MRAIN(IRAIN).LE.0) GO TO 620
          000   580 IF (MRAIN(IRAIN)- IYRDAY) 610, 590, 620
          000   590 A = RAIN(IRAIN)                                                EXOG1890
          000
          000 C..........WHETHER RAIN OR SNOW
          000       IF (A.GE.0.) GO TO 600                                         EXOG1900
          000       A = -A                                                         FXOG1910
          000       DASNOW = A + DASNOW                                            EXOG1920
          000       GO TO 610
          000   600 DARAIN = A + DARAIN                                            EXOG1930
          000   610 IRAIN = IRAIN + 1                                              FXOG1940
          000
          000 C..........DEPOSITION EVENTS
    NFW   000   620 IF(KYR.GE.IYR) GO TO 585
    -01   000       IRUN = IRUN + 1
          000   585 IF (MRUNON(IRUN).LE.0) GO TO 740
          000       IF (MRUNON(IRUN) - IYRDAY) 730, 690, 740
          000   690 DAYRUN = RUNON(IRUN) + DAYRUN                                  EXOG2080
          000       ERODE = ERODED(IRUN) + ERODE                                   EXOG2090
          000       DO 700 K = 1, NELEM                                            EXOG2100
          000   700 DRUNMI(K) = RUNMIN(IRUN,K) + DRUNMI(K)                         EXOG2110
          000       DO 710 K = 1, NFRFLM                                           EXOG2120
          000   710 DRUNOR(K)  =RUNORG(IRUN,K) + DRUNOR(K)                         EXOG2130
          000       DO 720 J=1,NRUNLT                                              EXOG2140
```

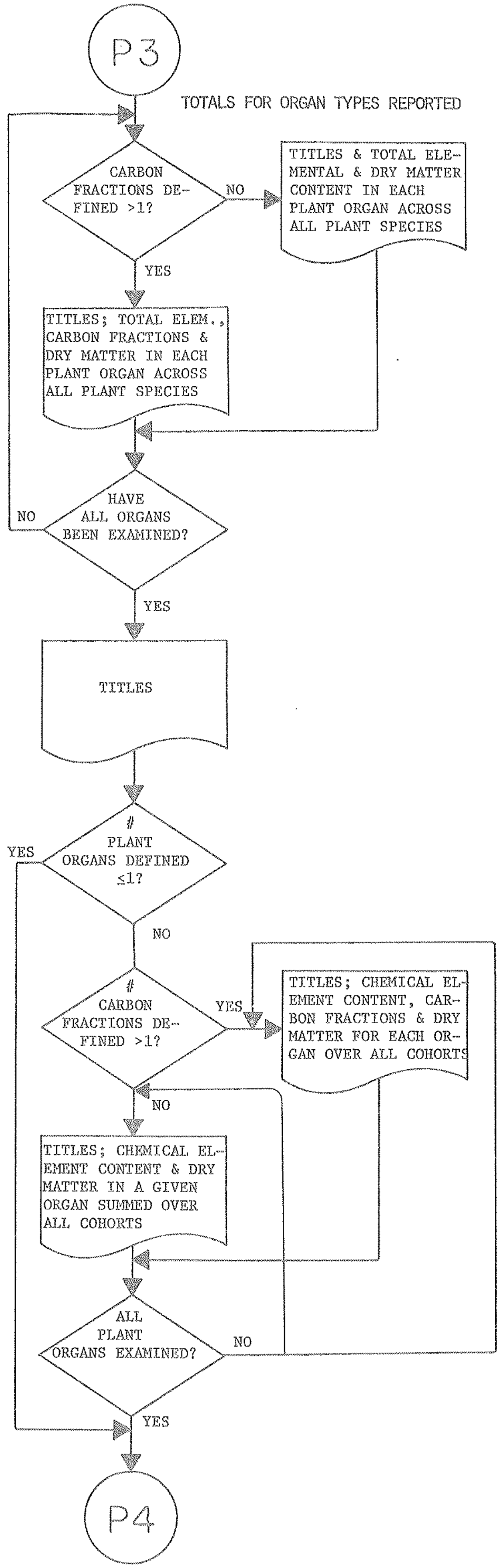
```
000        DO 720 K=1 ,NFPELM                                   EXOG2150
000    720 DRUNLT(J,K) = PUNLIT (IRUN,J,K) + DRUNLT(J,K)       EXOG2160
000    730 IRUN = IRUN + 1                                      EXOG2170
000    740 KDAY = IYRDAY                                        EXOG2180
000        KYR = IYR                                            EXOG2190
000        IF (MONTH.EQ.MONOLD) RETURN                          EXOG2200
000
000   C..........OTHER METEOROLOGICAL RECORDS
000        TDAY = TEMDAY(MONTH)                                 EXOG2210
000        TNIGHT = TEMNIT(MONTH)                               EXOG2220
000        EVAP = EVAPOP(MONTH)                                 EXOG2230
000        DAYWVP= WVP(MONTH)                                   EXOG2240
000        DWINAV = WINDAV(MONTH)                               EXOG2250
000        DWINMX = WINDMX(MONTH)                               EXOG2260
000        DAYRAD = RADIA(MONTH)                                EXOG2270
000        DAPHOT = PHOTOP(MONTH)                               EXOG2280
000        MONOLD = MONTH                                       EXOG2290
000        RETURN                                               EXOG2300
000        END                                                  EXOG2310
```

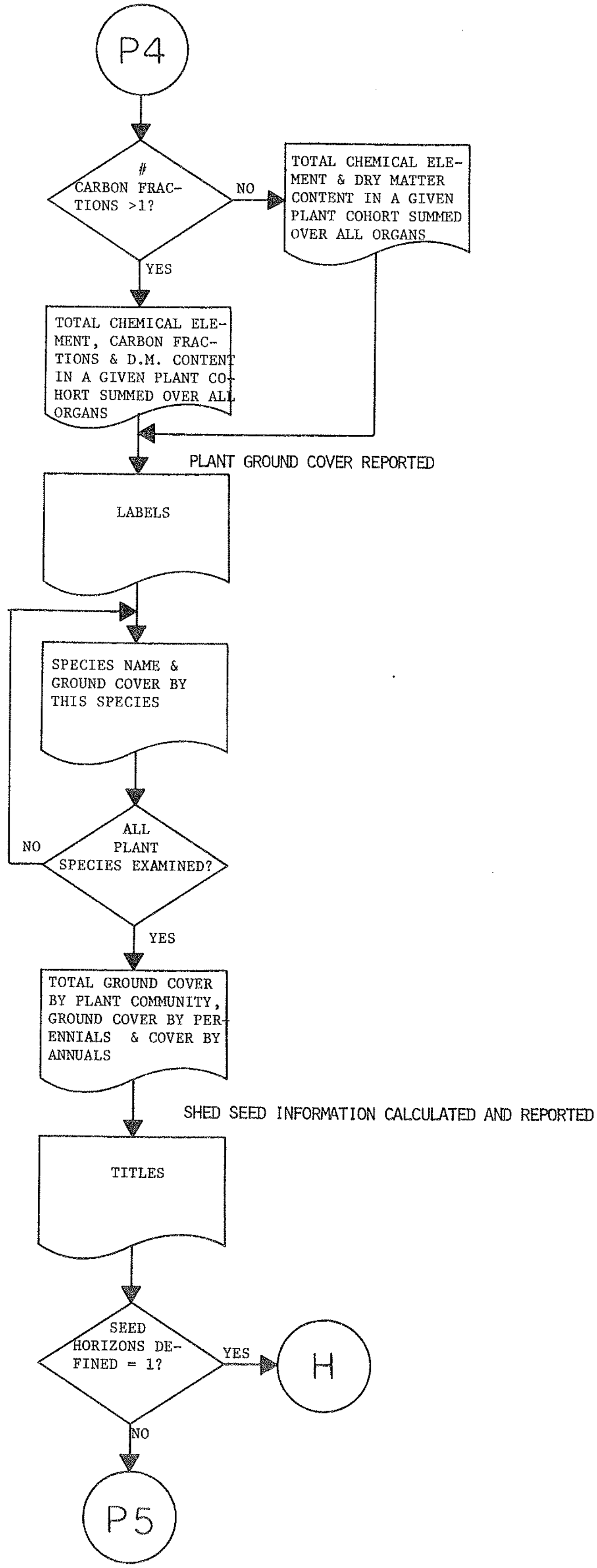
FLOW CHART OF REPORT

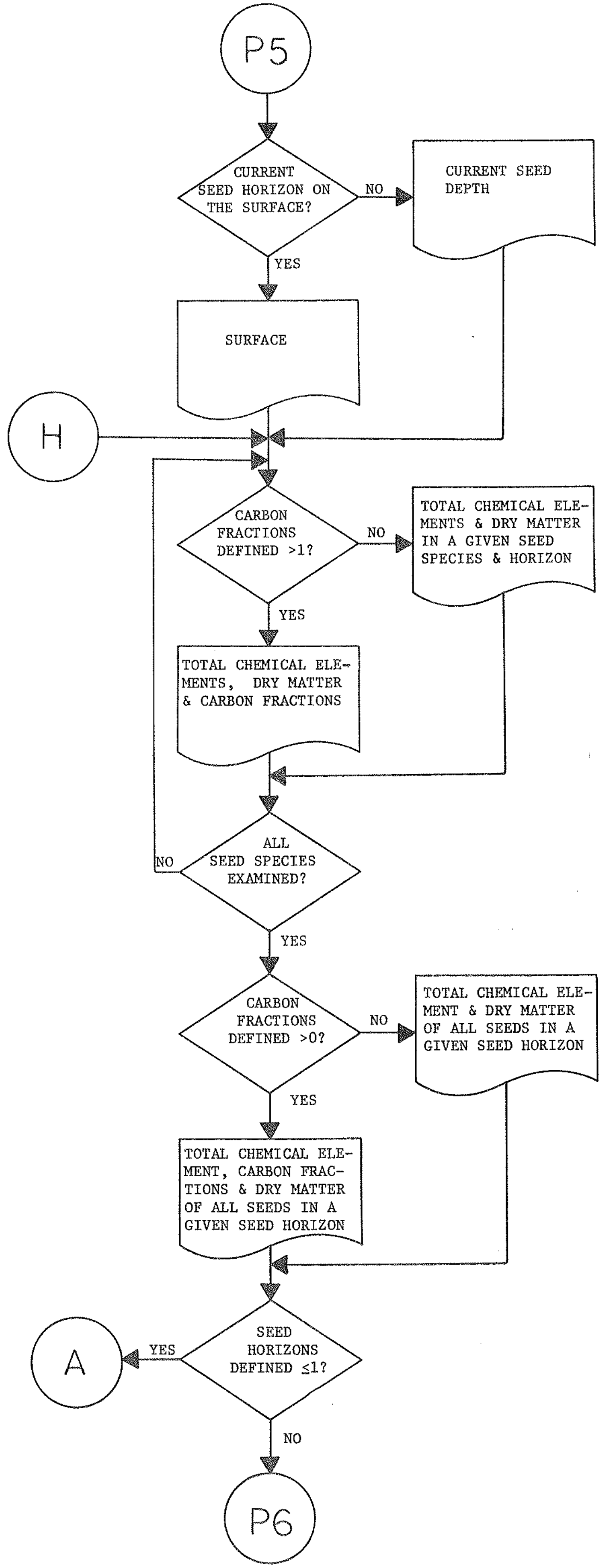


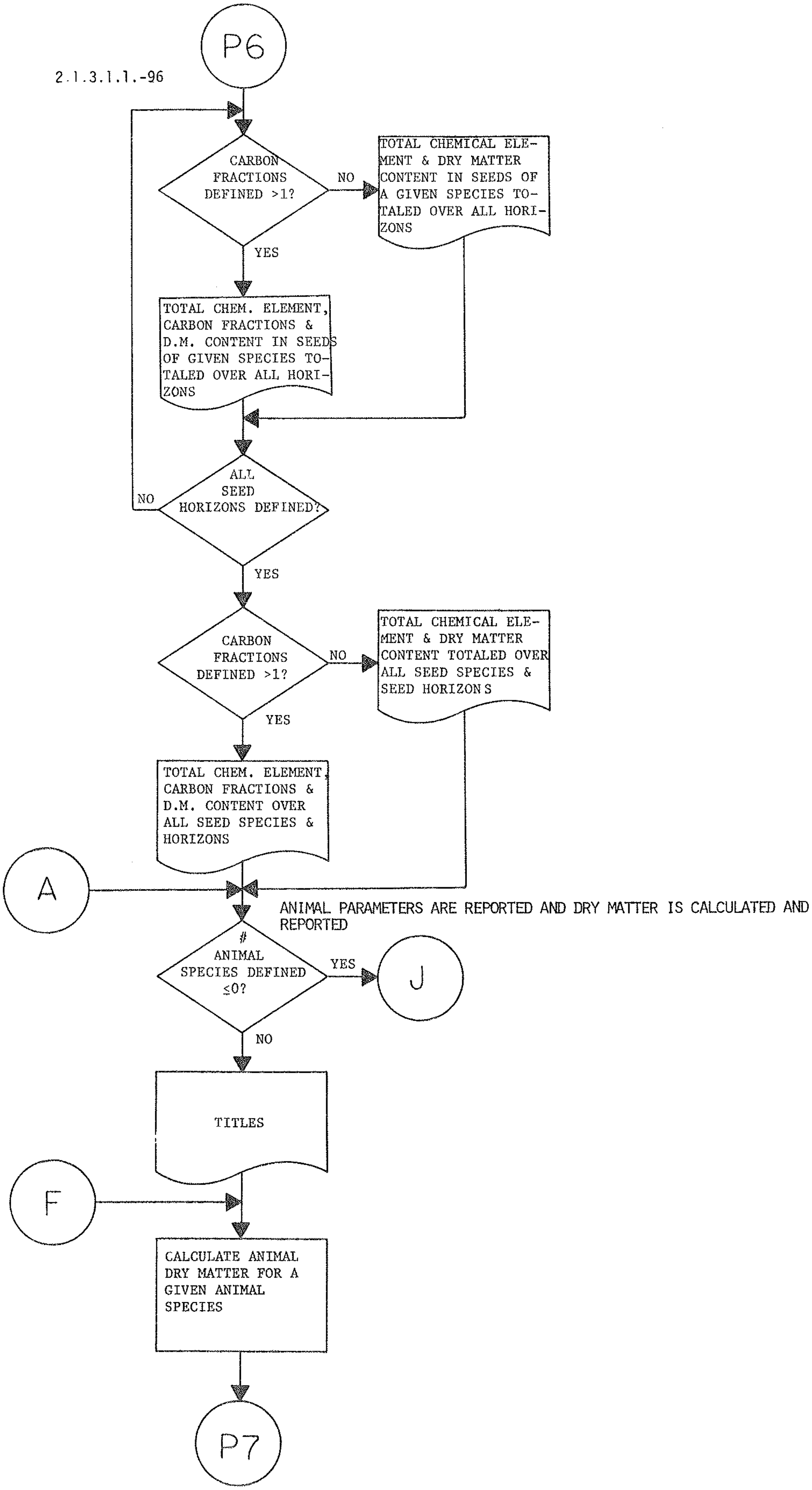
2.1.3.1.1.-92

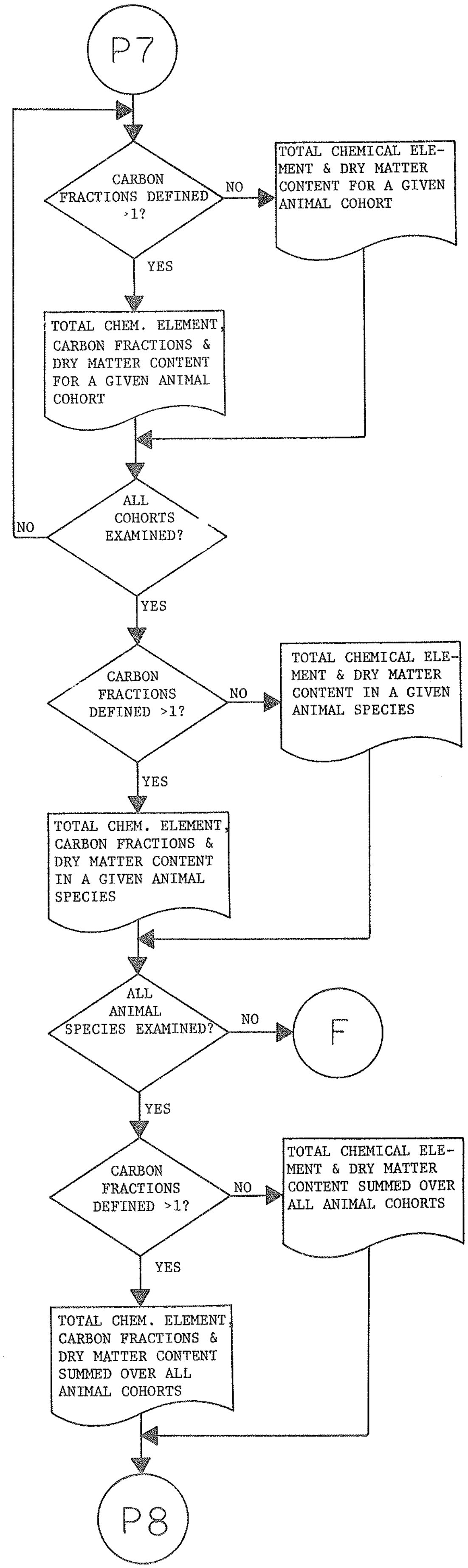

P2
B
PLANT ORGAN REPORTS
CARBON FRACTIONS IN PLANT ORGAN >1?
YES
NO
TOTAL CARBON & DRY MATTER IN ORGAN IN GIVEN COHORT
SUM OF EACH CARBON FRACTION IN PLANT ORGAN, IN EACH COHORT
TOTAL CHEMICAL ELEMENT AND DRY MATTER FOR EACH COHORT
TOTAL CHEMICAL ELEMENT, TOTAL CARBON & DRY MATTER FOR EACH COHORT
C
NO
ALL ORGANS EXAMINED?
YES
PLANT SPECIES REPORTS
COHORTS DEFINED ≤1?
NO
YES
TITLES
P3
YES
PLANT ORGANS DEFINED >1?
NO
CARBON FRACTIONS DEFINED >1?
YES
NO
ELEMENTAL CONTENT & DRY MATTER FOR EACH ORGAN TYPE ACROSS ALL PLANT COHORTS IN A GIVEN SPECIES
ELEM. CONTENT & CARBON FRACTIONS OF D.M. FOR EACH ORGAN TYPE ACROSS ALL PLANT COHORTS IN A GIVEN SPECIES

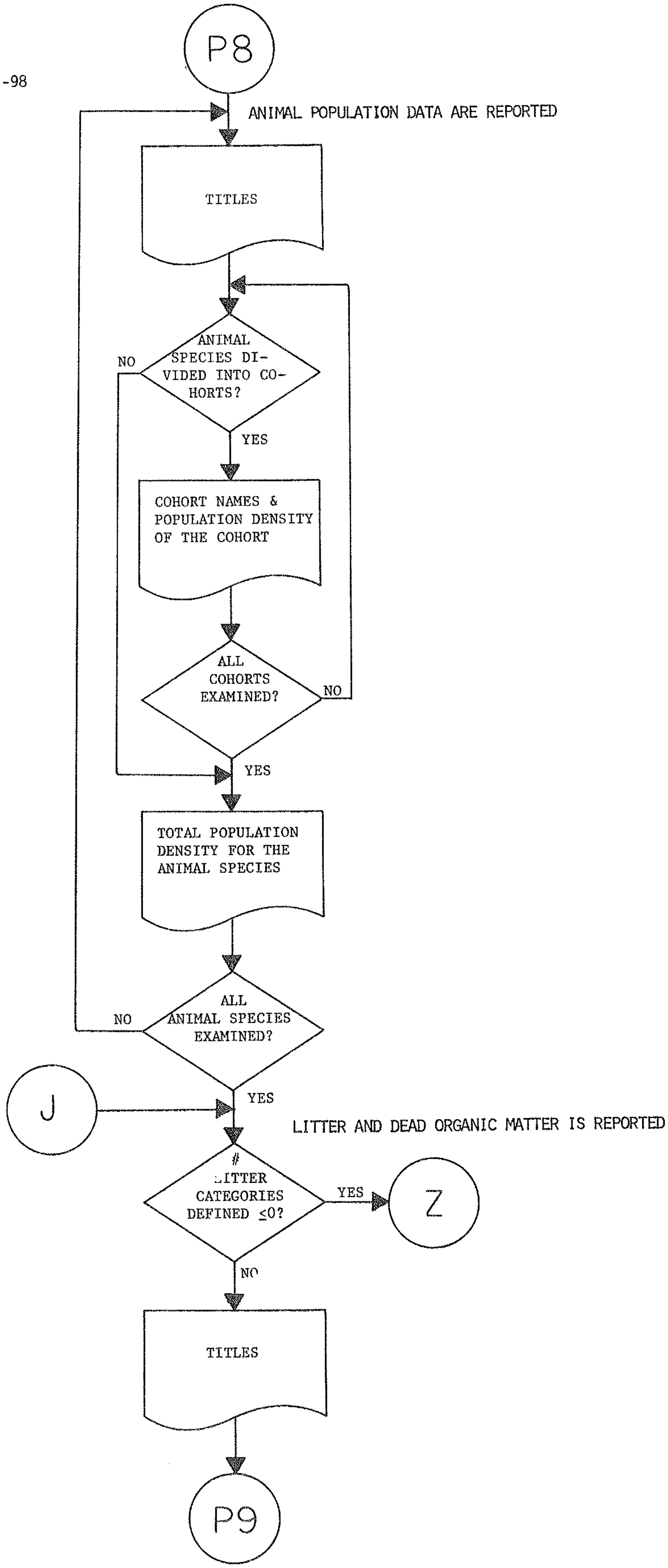

P3
TOTALS FOR ORGAN TYPES REPORTED
CARBON FRACTIONS DE- FINED >1?
NO
TITLES & TOTAL ELE- MENTAL & DRY MATTER CONTENT IN EACH PLANT ORGAN ACROSS ALL PLANT SPECIES
YES
TITLES; TOTAL ELEM., CARBON FRACTIONS & DRY MATTER IN EACH PLANT ORGAN ACROSS ALL PLANT SPECIES
HAVE ALL ORGANS BEEN EXAMINED?
NO
YES
TITLES
PLANT ORGANS DEFINED ≤1?
YES
NO
CARBON FRACTIONS DE- FINED >1?
YES
TITLES; CHEMICAL EL- EMENT CONTENT, CAR- BON FRACTIONS & DRY MATTER FOR EACH OR- GAN OVER ALL COHORTS
NO
TITLES; CHEMICAL EL- EMENT CONTENT & DRY MATTER IN A GIVEN ORGAN SUMMED OVER ALL COHORTS
ALL PLANT ORGANS EXAMINED?
NO
YES
P4

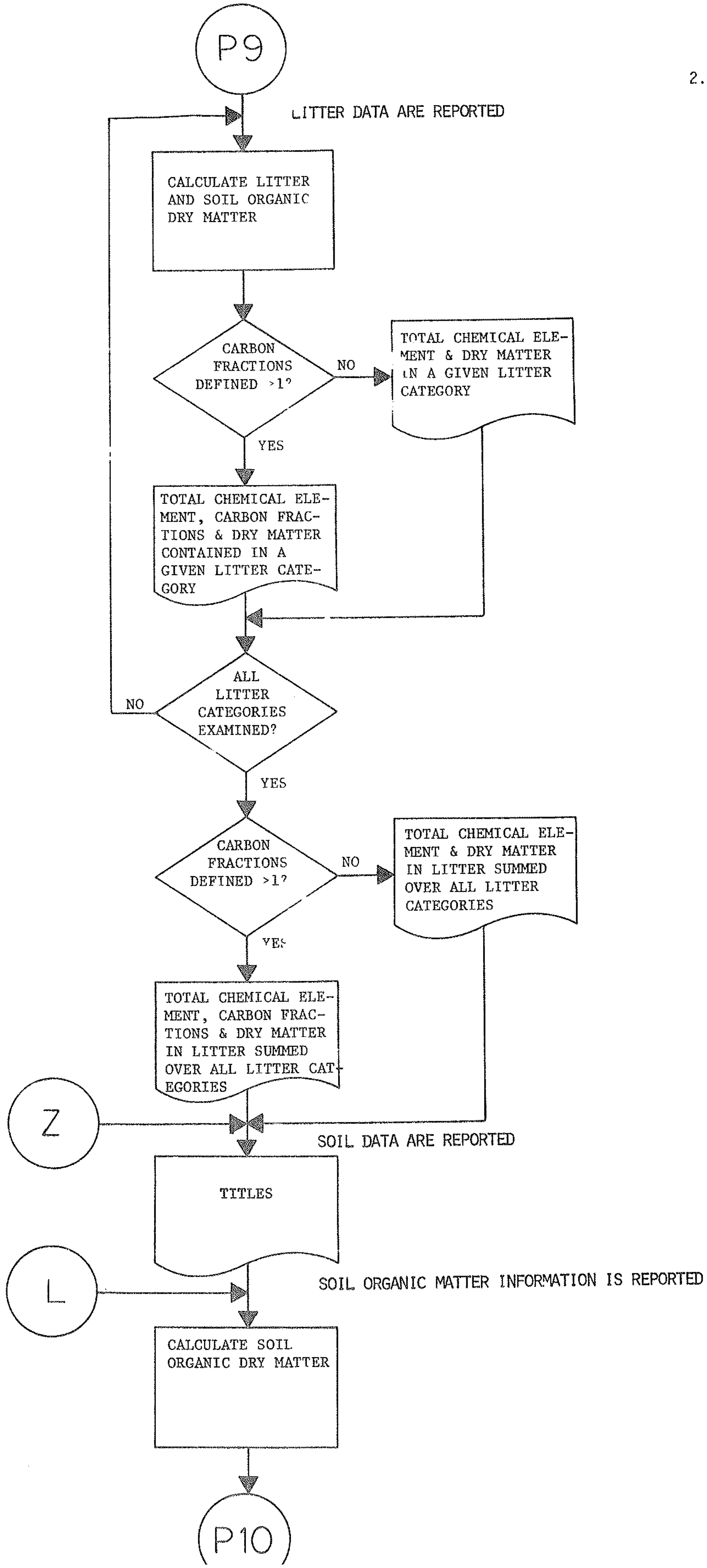

P4
CARBON FRACTIONS >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT IN A GIVEN PLANT COHORT SUMMED OVER ALL ORGANS
YES
TOTAL CHEMICAL ELEMENT, CARBON FRACTIONS & D.M. CONTENT IN A GIVEN PLANT COHORT SUMMED OVER ALL ORGANS
PLANT GROUND COVER REPORTED
LABELS
SPECIES NAME & GROUND COVER BY THIS SPECIES
ALL PLANT SPECIES EXAMINED?
NO
YES
TOTAL GROUND COVER BY PLANT COMMUNITY, GROUND COVER BY PERENNIALS & COVER BY ANNUALS
SHED SEED INFORMATION CALCULATED AND REPORTED
TITLES
SEED HORIZONS DEFINED = 1?
YES
H
NO
P5


P5
CURRENT SEED HORIZON ON THE SURFACE?
NO
CURRENT SEED DEPTH
YES
SURFACE
H
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELE-MENTS & DRY MATTER IN A GIVEN SEED SPECIES & HORIZON
YES
TOTAL CHEMICAL ELE-MENTS, DRY MATTER & CARBON FRACTIONS
ALL SEED SPECIES EXAMINED?
NO
YES
CARBON FRACTIONS DEFINED >0?
NO
TOTAL CHEMICAL ELE-MENT & DRY MATTER OF ALL SEEDS IN A GIVEN SEED HORIZON
YES
TOTAL CHEMICAL ELE-MENT, CARBON FRAC-TIONS & DRY MATTER OF ALL SEEDS IN A GIVEN SEED HORIZON
SEED HORIZONS DEFINED ≤1?
YES
A
NO
P6

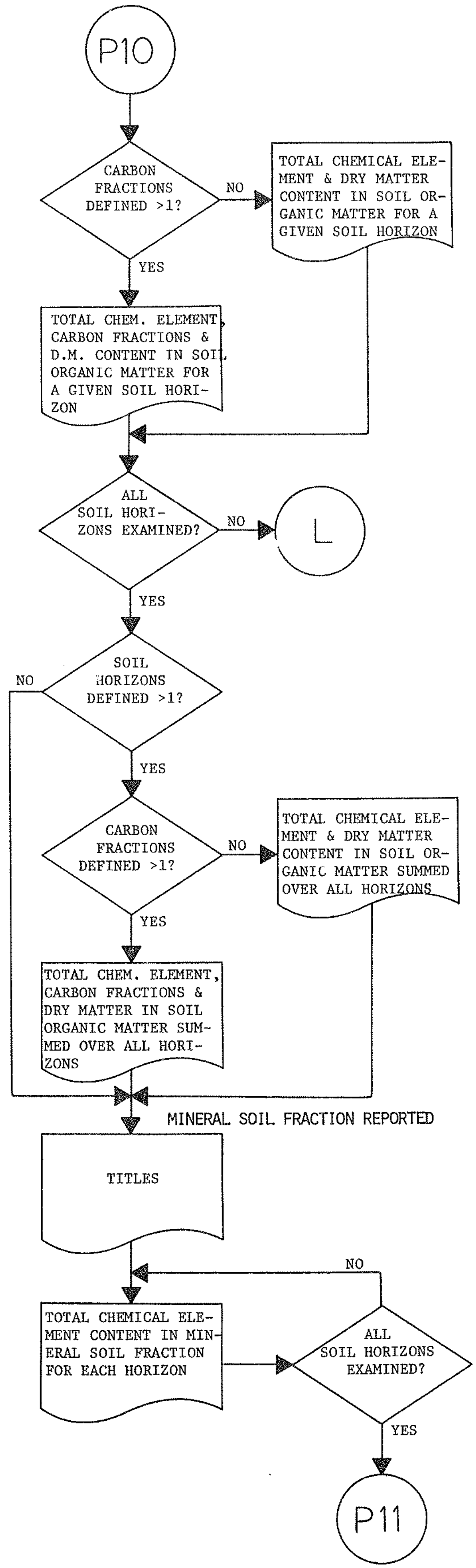

P6
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT IN SEEDS OF A GIVEN SPECIES TOTALED OVER ALL HORIZONS
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & D.M. CONTENT IN SEEDS OF GIVEN SPECIES TOTALED OVER ALL HORIZONS
ALL SEED HORIZONS DEFINED?
NO
YES
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT TOTALED OVER ALL SEED SPECIES & SEED HORIZONS
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & D.M. CONTENT OVER ALL SEED SPECIES & HORIZONS
A
ANIMAL PARAMETERS ARE REPORTED AND DRY MATTER IS CALCULATED AND REPORTED
ANIMAL SPECIES DEFINED ≤0?
YES
J
NO
TITLES
F
CALCULATE ANIMAL DRY MATTER FOR A GIVEN ANIMAL SPECIES
P7


P7
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT FOR A GIVEN ANIMAL COHORT
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & DRY MATTER CONTENT FOR A GIVEN ANIMAL COHORT
ALL COHORTS EXAMINED?
NO
YES
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT IN A GIVEN ANIMAL SPECIES
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & DRY MATTER CONTENT IN A GIVEN ANIMAL SPECIES
ALL ANIMAL SPECIES EXAMINED?
NO
F
YES
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT SUMMED OVER ALL ANIMAL COHORTS
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & DRY MATTER CONTENT SUMMED OVER ALL ANIMAL COHORTS
P8

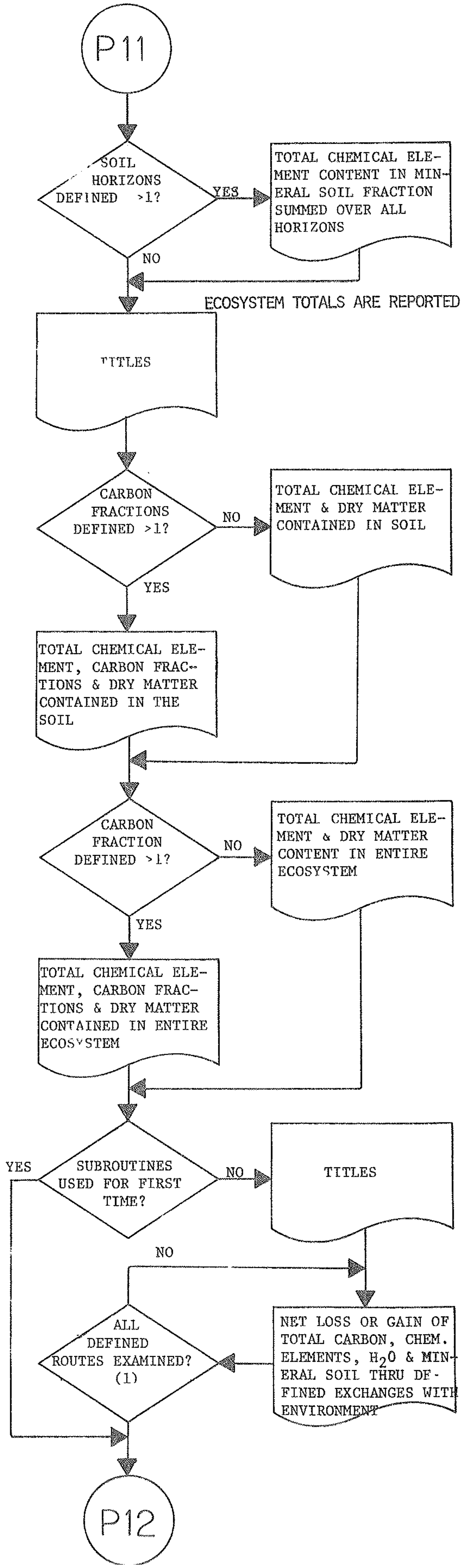

P8
ANIMAL POPULATION DATA ARE REPORTED
TITLES
ANIMAL SPECIES DIVIDED INTO COHORTS?
NO
YES
COHORT NAMES & POPULATION DENSITY OF THE COHORT
ALL COHORTS EXAMINED?
NO
YES
TOTAL POPULATION DENSITY FOR THE ANIMAL SPECIES
ALL ANIMAL SPECIES EXAMINED?
NO
YES
J
LITTER AND DEAD ORGANIC MATTER IS REPORTED
LITTER CATEGORIES DEFINED ≤0?
YES
Z
NO
TITLES
P9


P9
LITTER DATA ARE REPORTED
CALCULATE LITTER AND SOIL ORGANIC DRY MATTER
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER IN A GIVEN LITTER CATEGORY
YES
TOTAL CHEMICAL ELEMENT, CARBON FRACTIONS & DRY MATTER CONTAINED IN A GIVEN LITTER CATEGORY
ALL LITTER CATEGORIES EXAMINED?
NO
YES
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER IN LITTER SUMMED OVER ALL LITTER CATEGORIES
YES
TOTAL CHEMICAL ELEMENT, CARBON FRACTIONS & DRY MATTER IN LITTER SUMMED OVER ALL LITTER CATEGORIES
Z
SOIL DATA ARE REPORTED
TITLES
L
SOIL ORGANIC MATTER INFORMATION IS REPORTED
CALCULATE SOIL ORGANIC DRY MATTER
P10

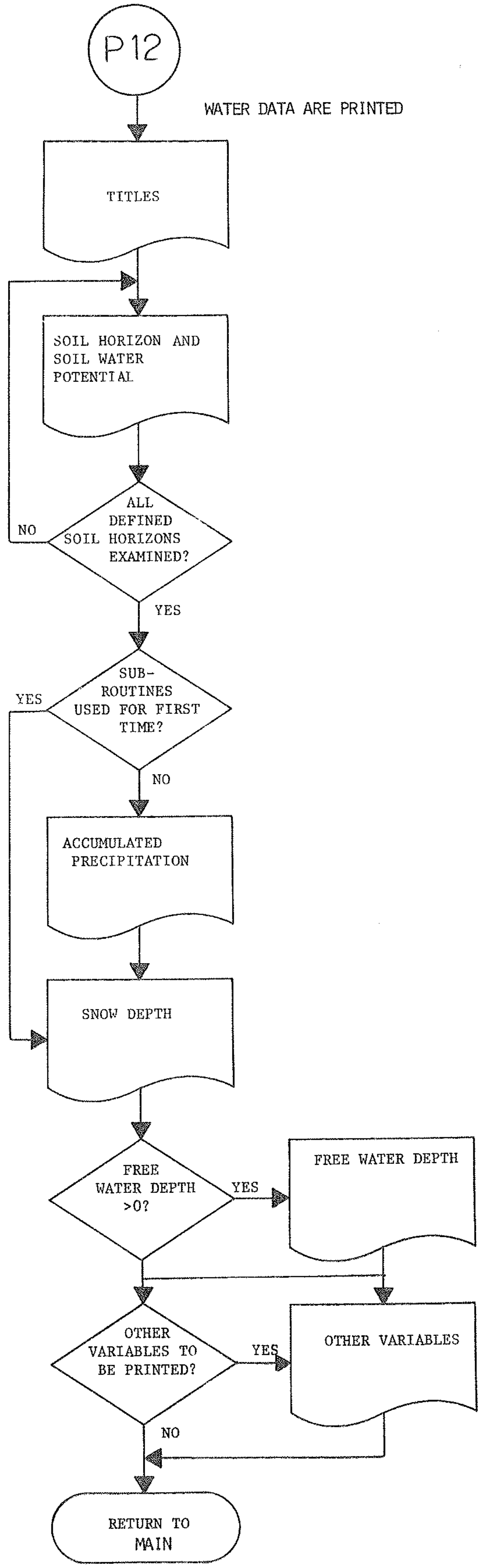
2.1.3.1.1.-100



P10
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT IN SOIL ORGANIC MATTER FOR A GIVEN SOIL HORIZON
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & D.M. CONTENT IN SOIL ORGANIC MATTER FOR A GIVEN SOIL HORIZON
ALL SOIL HORIZONS EXAMINED?
NO
L
YES
SOIL HORIZONS DEFINED >1?
NO
YES
CARBON FRACTIONS DEFINED >1?
NO
TOTAL CHEMICAL ELEMENT & DRY MATTER CONTENT IN SOIL ORGANIC MATTER SUMMED OVER ALL HORIZONS
YES
TOTAL CHEM. ELEMENT, CARBON FRACTIONS & DRY MATTER IN SOIL ORGANIC MATTER SUMMED OVER ALL HORIZONS
MINERAL SOIL FRACTION REPORTED
TITLES
NO
TOTAL CHEMICAL ELEMENT CONTENT IN MINERAL SOIL FRACTION FOR EACH HORIZON
ALL SOIL HORIZONS EXAMINED?
YES
P11



(1) ALL DEFINED ROUTES OF ECOSYSTEM EXCHANGE WITH THE ENVIRONMENT EXAMINED?


P12
WATER DATA ARE PRINTED
TITLES
SOIL HORIZON AND SOIL WATER POTENTIAL
ALL DEFINED SOIL HORIZONS EXAMINED?
NO
YES
SUB-ROUTINES USED FOR FIRST TIME?
YES
NO
ACCUMULATED PRECIPITATION
SNOW DEPTH
FREE WATER DEPTH >0?
YES
FREE WATER DEPTH
OTHER VARIABLES TO BE PRINTED?
YES
OTHER VARIABLES
NO
RETURN TO MAIN

REPORT
PROGRAM LISTING

```
C   THIS SUBROUTINE PRODUCES TABULAR REPORTS.
C THE FOLLOWING ARE DEFINITIONS OF VARIABLES NOT IN BLOCKS COMMON TO
C THE MAIN PROGRAM.      THOSE USED FOR TEMPORARY STORAGE ONLY ARE
C OMITTED.

C AGAIN (K)        NET GAIN OR LOSS OF THE K'TH ELEMENT BY THE ECOSYSTEM
C                  AS A WHOLE
C CARBON           THESE TWO LOCATIONS STORE THE HEADING FOR
C CARBC1           CARBON CONTENT COLUMNS.
C DRYM (J)         DRY MATTER (G. PER HECTARE) OF THE J'TH ORGAN OF THE
C                  PLANT COHORT CURRENTLY CONSIDERED, OR OF THE J'TH
C                  ANIMAL COHORT
C DRYMA1           THESE THREE LOCATIONS STORE THE HEADING
C DRYMA2           FOR DRY MATTER COLUMNS
C DRYMA3
C DRYMC            THE TOTAL DRY MATTER IN THE PLANT OR ANIMAL COHORT
C                  CURRENTLY CONSIDERED; FOR SEED OF A PARTICULAR
C                  SPECIES IN A PARTICULAR SOIL HORIZON; IN A PARTICULAR
C                  CATEGORY OF DEAD MATERIAL' OR IN ORGANIC MATTER OF A
C                  PARTICULAR SOIL HORIZON
C DRYMSP           THE DRY MATTER SUMMED OVER ALL ORGANS OF ALL COHORTS
C                  OF THE SPECIES CURRENTLY BEING PRINTED OUT IN THE
C                  WRITING OF A REPORT.
C DRYMV(I)         DRY MATTER (G PER HECTARE) OF THE I'TH PLANT ORGAN
C                  TYPE SUMMED OVER ALL SPECIES, OR OF THE I'TH ANIMAL
C                  SPECIES, SUMMED OVER ALL COHORTS
C DRYMVO           TOTAL DRY MATTER (G. PER HECTARE) IN PLANT OR ANIMAL
C                  MATERIAL; IN DEAD MATERIAL; IN SOIL ORGANIC MATTER;
C                  OR IN SEED OF ALL PLANT SPECIES FROM A GIVEN SOIL
C                  HORIZON
C DRYTH (S)        DRY MATTER (G. PER HECTARE) IN SEED OF THE S'TH PLANT
C                  SPECIES, SUMMED OVER ALL SOIL HORIZONS
C DRYTVH           TOTAL DRY MATTER (G. PER HECTARE) IN ALL SEED
C EROTOT           NET GAIN OR LOSS OF MINERAL SOIL BY THE WHOLE
C                  ECOSYSTEM
C H2OTOT           NET GAIN OR LOSS OF WATER BY THE WHOLE ECOSYSTEM
C NELEM3           THE NUMBER OF CHEMICAL ELEMENTS * 3; USED AS A DO-LOOP
C                  PARAMETER
C NERELZ           THE TOTAL NUMBER OF CONSTITUENTS *3; USED AS A DO-LOOP
C                  PARAMETER
C ORGDM            THESE THREE LOCATIONS STORE THE
C ORGDM1           HEADING FOR ORGANIC DRY
C ORGDM2           MATTER COLUMNS
C ORGDMA           TOTAL DRY MATTER IN SOIL ORGANIC MATTER AND OTHER DEAD
C                  MATERIAL
C ORGDMT           TOTAL ORGANIC DRY MATTER IN THE ECOSYSTEM
C SDRYM(J)         TOTAL DRY MATTER (G. PER HECTARE) OF THE J'TH ORGAN
C                  TYPE OF ALL COHORTS OF THE PLANT SPECIES CURRENTLY
C                  CONSIDERED
C SOURCE(JJ,P)     NAME OF THE P'TH CHANNEL (SEE 'AGAIN' IN MAIN PROGRAM)
C                  FOR GAIN OR LOSS TO SYSTEM (JJ = 1,6)
C TOTNAM           THESE TWO LOCATIONS STORE THE HEADING
C TOTNAI           FOR TOTAL CARBON COLUMNS
```

```
      SUBROUTINE REPORT                                                 REPT0010
C-----------------------------------------------------------------------
C      THE COMMON BLOCK /NAMES/ CONTAINS THE NAMES REQUIRED FOR
C      TABULATED OUTPUT
C-----------------------------------------------------------------------
       COMMON/NAMES/CONNAM(20,4),VCONAM(10,4),VERNAM(10,7),ACRNAM(10,7),
     1 ORGNAM(10,5),ECANAM(10,3),ALTNAM(15,6)
C-----------------------------------------------------------------------
C      COMMON BLOCK /ACC/ CONTAINS ACCUMULATED CHANGES, WHICH MAY BE
C      NEGATIVE.  COMMON BLOCK /ACCINC/ CONTAINS THE INCREMENTS TO THE
C      ARRAYS IN /ACC/ FOR A SINGLE TIME UNIT.
C-----------------------------------------------------------------------
       COMMON /ACC/ ACAIN(3,4),EROD(7),H2O(7)
C-----------------------------------------------------------------------
C      COMMON BLOCK /SPEC/ CONTAINS SPECIFICATIONS AND OTHER INFORMATION
C      COMMON TO THE WHOLE SET OF PROGRAMS, BUT EXCLUDING STATE AND
C      EXOGENOUS VARIABLES.
C-----------------------------------------------------------------------
       COMMON/SPEC/NCHAN,INSTPU(20),          NSPECV,NSPECA,NORGAN,NEPACT,
     1 NDAY,NELEM,NOLIT,NCHECK,IDAY,IYRDAY,NDEPET(20),NDEBUG,NHORIZ
     2,NCOH(10),LISCOH(30),NCOHCU(10),NCOMOR,NERELM,NEPAC1,NSPCOH,MONTH,
     3 HORDEP(6),LITRUN(5),MREP(20),IYR,DRYFAV(3,6),LITCAT(15)
     4,NVECOH,LISVCO(15),NVCOH(10),NVCOCU(10),NOSECS,IRUN,NRUNLT
     5,ISTD,JSTD,ILIT,JLIT,ILH,JLH,SEEDEP(6),NSEEDH,NELEMS,JSTATE,JDAY
     6,LOOPER
C-----------------------------------------------------------------------
C      COMMON BLOCK /OTHER/ CONTAINS A NUMBER OF VARIABLES OTHER THAN
C      STATE VARIABLES NEEDED FOR COMMUNICATION BETWEEN THE MAIN PROGRAM
C      AND SUBROUTINES.
C-----------------------------------------------------------------------
       COMMON/OTHER/ATOT,ATOTO,SNODEP,SOILTE(5),PRECMM, WATER(5)
C-----------------------------------------------------------------------
C      COMMON BLOCK /TOTALS/ CONTAINS SUMS OF THE STATE VARIABLES,
C      TOGETHER WITH CERTAIN OTHER VARIABLES REQUIRING INITIALIZATION
C      BUT NOT INCREMENTATION AT EACH TIME UNIT.
C-----------------------------------------------------------------------
       COMMON/TOTALS/CVEGV(10,6),CVEGO(15,5),CVEGVO(6),AVEGV(10),AVEGO(15
     1),AVEGVO,ABIOMA,CBIOMA(6),ALITT,CLITT(15),SEEDVH(5),ABIOSP(10),
     2TOT(6),POPSP(10),AVEG(15,10),ABIOM(70),ALIT(15),AORG(5),TOTAL(5),
     3ANIM(10,6),SVEG(10,15,6),SAVEG(10,10),SVEGO(10,5),SAVEGO(10)
     4 ,ASEED(10,5),ASEEDV(6),ASEEDH(10),ASEEDT,SEEDV(6,5),SEEDH(10,5),
     5 CORGH(6),AORGH, CMINH(6)
C-----------------------------------------------------------------------
C      COMMON BLOCK /STAT/ CONTAINS THE STATE VARIABLES, AND /CHANGE/
C      THEIR INCREMENTS OR DECREMENTS FOR THE CURRENT TIME UNIT.
C-----------------------------------------------------------------------
       COMMON/STAT/CVEG(15,10,6),SEED(10,5,6),POP(70),BIOM(70,5),
     1 CLITT(15,6), CORG(5,6), CMIN(5,5), SNOCOV,WATABS(5),
     2 ANNCOV,PERCOV,TCOVER,COVER(15),FREWAT,DUMMY(700)
       DIMENSION DRYM(70),DRYMV(15),DRYTH(15),CDRYM(10),SOURCE(6,7),
     1 ACAINT(3)
       DATA ORGDM/'  OR'/,ORGDM1/'G.D.'/,ORGDM2/'M.  '/                 REPT0040
       DATA CARBON/'  CA'/, CARBO1/'RBON'/                              REPT0050
       DATA BLANK/'  '/, TOTNAM/'TOTA'/, TOTNAT/'L   '/                 REPT0060
       DATA SOURCE/'TO 0','R FR','OM A','TMOS','PHER','E    ','DRY R',  REPT0070
     1 'UN-O','FF O','R RU','N-ON',' ','TO 0','R FR','OM ','UPSO',      REPT0080
```

```
     2 'TL  ','  '/
       DATA DRYMA1/'  DR'/,DRYMA2/'Y MA'/,DRYMA3/'TTER'/
       NFREL3=3*NFRELM
       NFLEM3=3*NELEM
       ORGDMT=0.
    10 FORMAT (1X, 30A4)
    20 IF(NOSECS.LE.0) GO TO 40
C-----------------------------------------------------------------
C      THE CPU TIMER IS REPORTED AND RESET
C-----------------------------------------------------------------
       TIMER= EXTIME(0)
       WRITE (6,30) TIMER
    30 FORMAT  ('+', 103X, F1 .3, ' SECONDS ELAPSED')
    40 IF (NSPECV.LE.0) GO TO 550
C-----------------------------------------------------------------
C      PLANT BIOMASS DATA ARE PRINTED
C-----------------------------------------------------------------
       WRITE (6,50)
    50 FORMAT('0CONSTITUENTS OF VEGETATIONAL BIOMASS, G. OR KCAL. PER HEC
     1TARE')
    60 FORMAT (30X, 32A4)
       WRITE (6,60) ((FRANAM(I,J), J = 1,3), I = 1,NFRELM)
       IF(NFRACT.GT.1) WRITE(6,70)(BLANK,J=1,NFREL3),TOTNAM,TOTNAT
     1      ,DRYMA1, DRYMA2, DRYMA3
    70 FORMAT ('+', 30X, 32A4)
       IF(NFRACT.LE.1)WRITE(6,70)(BLANK,J=1,NFREL3),DRYMA1,DRYMA2,DRYMA
 
C..........DRY MATTER IS CALCULATED
       DO 80 J = 1, NORGAN
    80 DRYMV(J) = 0.
       DRYMVO = 0.
       I8 = 0
       K1 = 1
       I7=1
       DO 270 I9 = 1, NSPECV
       IF (NVCOH(I9).GT.1) I8 = I8 + 1
       DO 90 J = 1, NORGAN
    90 SDRYM(J) = 0.
       DRYMSP = 0.
       K2 =       NVCOCU(I9)
       IF (I9.GT.1) K1 = NVCOCU(I9-1) + 1
       DO 200 I = K1, K2
       DRYMO = 0.
       DO 110 J = 1, NORGAN
       DRYM(J) = 0.
       DO 100 K = 1, NFRELM
   100 DRYM(J) = DRYM(J) + CVC(I,J,K) * DRYFAV(I7,K)
       DRYMV(J) = DRYMV(J) + DRYM(J)
       SDRYM(J) = SDRYM(J) + DRYM(J)
       DRYMO = DRYMO + DRYM(J)
   110 CONTINUE
       DRYMVO = DRYMVO + DRYMO
       DRYMSP = DRYMSP + DRYMO
 
C..........INDIVIDUAL VALUES ARE PRINTED
       WRITE(6,10)(VSPNAM(I9,J),J=1,7)
       IF (K2.GT.K1) WRITE (6,120) (VCONAM(I, ), J=1,4)
```

```
000      120 FORMAT     (15X, 4A4)                                                   PEPT0760
000          IF (NORGAN.GT.1) GO TO 150                                              PEPT0770
000          IF(NFRACT.GT.1) GO TO 130                                               PEPT0780
000          WRITE (6,140) (CVEG(I,1,K), K=1,NFRELM), DRYM(1)                        PEPT0790
000          GO TO 200                                                               PEPT0800
000      130 WRITE (6,140) (CVEG(I,1,K), K = 1, NFRELM), AVEG(I,1), DRYM(1)          PEPT0810
000      140 FORMAT ('+', 26X, 8F12.2)                                               PEPT0820
000          GO TO 200                                                               PEPT0830
000      150 DO 180 J = 1, NORGAN                                                    PEPT0840
000          IF (NFRACT.GT.1) GO TO 170                                              PEPT0850
000          WRITE (6,160) (ORGNAM(J,K), K = 1,6), (CVEG (I,J,K), K=1,NFRELM)        PEPT0860
000         1,DRYM(J)                                                                PEPT0870
000      160 FORMAT(7X, 6A4,     8F12.2)                                             PEPT0880
000          GO TO 180                                                               PEPT0890
000      170 WRITE (6,160) (ORGNAM(J,K), K = 1,6), (CVEG (I,J,K),K=1,NFRELM),        PEPT0900
000         1VEG(I,J), DRYM(J)                                                       PEPT0910
000      180 CONTINUE                                                                PEPT0920
000          IF(NFRACT.GT.1)GO TO 190                                                PEPT0930
000          WRITE (6,280) (CVEGO(I,K), K=1,NFRELM), DRYMO                           PEPT0940
000          GO TO 200                                                               PEPT0950
000      190 WRITE (6,280) (CVEGO(I,K), K=1,NFRELM), AVEGO(I), DRYMO                 PEPT0960
000      200 CONTINUE                                                                PEPT0970
000          IF (NVCOH(I9).LE.1) GO TO 270                                           PEPT0980
000
000     C..........TOTALS FOR SPECIES OR SPECIES GROUPS ARE PRINTED
000          WRITE (6,10) (VSPNAM(I9,J), J=1,7)                                      PEPT0990
000          WRITE (6,210)                                                           PEPT1000
000      210 FORMAT (15X, 'ALL STAGES')                                              PEPT1010
000          IF (NORGAN.GT.1) GO TO 230                                              PEPT1020
000          IF (NFRACT.GT.1) GO TO 220                                              PEPT1030
000          WRITE (6,140) (SVEG(I8,1,K), K=1,NFRELM), SDRYM(1)                      PEPT1040
000          GO TO 270                                                               PEPT1050
000      220 WRITE (6,140) (SVEG(I8,1,K), K=1,NFRELM),SAVEG(I8,1), SDRYM(1)          PEPT1060
000          GO TO 270                                                               PEPT1070
000
000     C..........TOTALS FOR ORGAN TYPES ARE PRINTED
000      230 DO 250 J = 1, NORGAN                                                    PEPT1080
000          IF (NFRACT.GT.1) GO TO 240                                              PEPT1090
000          WRITE (6,160) (ORGNAM(J,K),K=1,6),(SVEG(I8,J,K),K=1,NFRELM),            PEPT1100
000         1SDRYM(J)                                                                PEPT1110
000          GO TO 250                                                               PEPT1120
000      240 WRITE (6,160) (ORGNAM(J,K),K=1,6),(SVEG(I8,J,K),K=1,NFRELM),            PEPT1130
000         1SAVEG(I8,J), SDRYM(J)                                                   PEPT1140
000      250 CONTINUE                                                                PEPT1150
000          IF (NFRACT.GT.1) GO TO 260                                              PEPT1160
000          WRITE (6,280) (SVEGO(I8,K),K=1,NFRELM),DRYMSP                           PEPT1170
000          GO TO 270                                                               PEPT1180
000      260 WRITE (6,280) (SVEGO(I8,K),K=1,NFRELM),SAVEGO(I8), DRYMSP               PEPT1190
000      270 CONTINUE                                                                PEPT1200
000      280 FORMAT ( 8X,'TOTAL', 14X,3F12.2)                                        PEPT1210
000          ORGDMT = ORGDMT + DRYMVC                                                PEPT1220
000          WRITE (6,290)                                                           PEPT1230
000      290 FORMAT ('CALL SPECIES')                                                 PEPT1240
000          IF(NORGAN.LE.1) GO TO 320                                               PEPT1250
000          DO 310 J=1,NORGAN                                                       PEPT1260
000          IF(NFRACT.GT.1)GO TO 300                                                PEPT1270
000          WRITE(6,160)(ORGNAM(J,K),K=1,6),(CVEGV(J,K),K=1,NFRELM),DRYMV(J)        PEPT1280
```

```
000          GO TO 310                                                         REPT1290
000      300 WRITE(6,160)(ORGNAM(J,K),K=1,6),(CVEGV(J,K),K=1,NFRELM),AVEGV(J)  REPT1300
000         1,DRYMV(J)                                                         REPT1310
000      310 CONTINUE                                                          REPT1320
000      320 IF(NFRACT.GT.1)GO TO 330                                          REPT1330
000          WRITE (6,280) (CVEGVO(K), K = 1,NFRELM),DRYMVO                    REPT1340
000          GO TO 340                                                         REPT1350
000      330 WRITE (6,280) (CVEGVO(K), K = 1,NFRELM),AVEGVO,DRYMVO             REPT1360
000
000    C..........COVER DATA ARE PRINTED
000      340 WRITE (6,350)                                                     REPT1370
000      350 FORMAT ('0GROUND COVER BY DIFFERENT PLANT SPECIES, PER CENT.')    REPT1380
000          DO 360 I = 1, NSPECV                                              REPT1390
000      360 WRITE (6,370) (VSPNAM(I,J), J = 1,7), COVER(I)                    REPT1400
000      370 FORMAT (20X, 7A4, 2PF20.3)
000          WRITE(6,380) TCOVER                                               REPT1420
000      380 FORMAT (T10, 'TOTAL', T49, 2PF20.3)
000          WRITE (6,385) PERCOV, ANNCOV
000      385 FORMAT (42X,'PERENNIALS',2PF10.3,' ANNUALS', 2PF10.3)
000    C------------------------------------------------------------------------
000    C       BIOMASS OF SHED SEEDS IS PRINTED
000    C------------------------------------------------------------------------
000          WRITE (6,390)                                                     REPT1440
000      390 FORMAT ('0CONSTITUENTS OF SHED SEEDS')                            REPT1450
000          WRITE (6,570) ((FRANAM(I,J), J = 1,3), I = 1,NFRELM)              REPT1460
000          IF(NFRACT.GT.1) WRITE(6,70)(BLANK,J=1,NFREL3),TOTNAM,TOTNAT       REPT1470
000         1     ,DRYMA1, DRYMA2, DRYMA3                                      REPT1480
000          IF(NFRACT.LE.1)WRITE(6,70)(BLANK,J=1,NFREL3),DRYMA1,DRYMA2,DRYMA3 REPT1490
000          DO 400  I = 1, NSEEDH                                             REPT1500
000      400 DRYTH(I) = 0.                                                     REPT1510
000          DRYTVH = 0.                                                       REPT1520
000          DO 500  K1 = 1, NSEEDH                                            REPT1530
000          IF (NSEEDH.EQ.1) GO TO 440
000          IF (K1.LE.1) GO TO 420                                            REPT1540
000          K2 = K1 - 1                                                       REPT1550
000          WRITE (6,410 ) SEEDEP(K2), SEEDEP(K1)                             REPT1560
000      410 FORMAT ( '    FROM', F5.0,' TO ', F5.0, ' MM.')                   REPT1570
000          GO TO 440                                                         REPT1580
000      420 WRITE (6,430)                                                     REPT1590
000      430 FORMAT ('    SURFACE')                                            REPT1600
000
000    C..........DRY MATTER IS CALCULATED
000      440 DRYMVO = 0.                                                       REPT1610
000          DO480 I = 1, NSPECV                                               REPT1620
000          DRYMO = 0.                                                        REPT1630
000          DO 450 K=1,NFRELM                                                 REPT1640
000      450 DRYMO = DRYMO + SEED(I,K1,K) * DRYFAV(I7,K)                       REPT1650
000          DRYMVO=DRYMVO+DRYMO                                               REPT1660
000          DRYTH(I) = DRYTH(I) + DRYMO                                       REPT1670
000
000    C..........INDIVIDUAL VALUES ARE PRINTED
000          IF (NFRACT.GT.1) GO TO 470                                        REPT1680
000          WRITE(6,460)(VSPNAM(I,J),J=1,7),(SEED(I,K1,J),J=1,NFRELM),DRYMO   REPT1690
000      460 FORMAT(' ',7A4,F10.2, 7F12.2)                                     REPT1700
000          GO TO 480                                                         REPT1710
000      470 WRITE(6,460)(VSPNAM(I,J),J=1,7),(SEED(I,K1,J),J=1,NFRELM),        REPT1720
000         1ASEED(I,K1), DRYMO                                                REPT1730
```

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  480 CONTINUE                                                                REPT1740
      IF (NFRACT.GT.1) GO TO 490                                              REPT1750
      WRITE (6,280) (SEEDV(K1,K),K=1,NFRELM), DRYMVO                          REPT1760
      GO TO 500                                                               REPT1770
  490 WRITE (6,280)(SEEDV(K1,K),K=1,NFRELM),ASEEDV(K1), DRYMVO                REPT1780
  500 DRYTVH = DRYTVH + DRYMVO                                                REPT1790
      ORGDMT = ORGDMT + DRYTVH                                                REPT1800
      IF (NSEEDH.LE.1) GO TO 550                                              REPT1810

C..........TOTALS OVER HORIZONS ARE PRINTED
      WRITE (6,510)                                                           REPT1820
  510 FORMAT('0  ALL HORIZONS')                                               REPT1830
      DO 530 I = 1, NSPECV                                                    REPT1840
      IF (NFRACT.GT.1) GO TO 520                                              REPT1850
      WRITE (6,460) (VSPNAM(I,J),J=1,7),(SEEDH(I,K),K=1,NFRELM),              REPT1860
     1DRYTH(I)                                                                REPT1870
      GO TO 530                                                               REPT1880
  520 WRITE (6,460) (VSPNAM(I,J), J=1,7),(SEEDH(I,K),K=1,NFRELM),             REPT1890
     1ASEEDH(I), DRYTH(I)                                                     REPT1900
  530 CONTINUE                                                                REPT1910
      IF (NFRACT.GT.1) GO TO 540                                              REPT1920
      WRITE (6,280) (SEEDVH(K), K=1,NFRELM), DRYTVH                           REPT1930
      GO TO 550                                                               REPT1940
  540 WRITE (6,280) (SEEDVH(K), K=1,NFRELM), ASEEDT,DRYTVH                    REPT1950
  550 IF (NSPECA.LE.0) GO TO 790                                              REPT1960
C-----------------------------------------------------------------------------------
C     ANIMAL DATA ARE PRINTED
C-----------------------------------------------------------------------------------
      WRITE (6,560)                                                           REPT1970
  560 FORMAT ('0CONSTITUENTS OF ANIMAL BIOMASS, G. OR KCAL.PER HECTARE')REPT1980
      WRITE (6,570) ((FRANAM(I,J), J = 1,7), I = 1,NFRELM)                    REPT1990
      IF(NFRACT.GT.1) WRITE(6,70)(BLANK,J=1,NFREL3),TOTNAM,TOTNAT             REPT2000
     1     ,DRYMA1, DRYMA2, DRYMA3                                            REPT2010
      IF(NFRACT.LE.1)WRITE(6,70)(BLANK,J=1,NFREL7),DRYMA1,DRYMA2,DRYMA3 REPT2020
  570 FORMAT (30X, 24A4)                                                      REPT2030

C..........DRY MATTER IS CALCULATED
      DRYMVO = 0.                                                             REPT2040
      K1=1                                                                    REPT2050
       I7=2                                                                   REPT2060
      DO 690 I = 1, NSPECA                                                    REPT2070
      IF(I.GT.1) K1=NCOHCU(I-1)+1                                             REPT2080
      K2=NCOHCU(I)                                                            REPT2090
      WRITE(6,580) (ASPNAM(I,J), J=1,7)                                       REPT2100
  580 FORMAT ('    ', 7A4)                                                    REPT2110
      DRYMV(I) = 0.                                                           REPT2120
      DO 600 J = K1, K2                                                       REPT2130
      DRYM(J) = 0.                                                            REPT2140
      DO 590 K = 1, NFRELM                                                    REPT2150
  590 DRYM(J) = DRYM(J) + CBIOM(J,K) * DRYFAV(I7,K)                           REPT2160
      DRYMV(I) = DRYMV(I) + DRYM(J)                                           REPT2170
  600 CONTINUE                                                                REPT2180
      DRYMVO = DRYMVO + DRYMV(I)                                              REPT2190
      IF(K2.GT.K1) GO TO 630                                                  REPT2200
      IF(NFRACT.GT.1)GO TO 610                                                REPT2210

C..........INDIVIDUAL BIOMASS VALUES ARE PRINTED
```

```
      WRITE (6,620) (CBIOM(K1,J), J=1,NFRELM), DRYM(K1)
      GO TO 690
  610 WRITE (6,620) (CBIOM(K1,J), J=1,NFRELM), ABIOM(K1), DRYM(K1)
  620 FORMAT ('+',25X, 8F12.2)
      GO TO 690
  630 DO 650 K = K1, K2
      L=LISCOH(K)
      IF(NFRACT.GT.1)GO TO 640
      WRITE(6,660)(COHNAM(L,J),J=1,4),(CBIOM(K,J),J=1,NFRELM),DRYM(K)
      GO TO 650
  640 WRITE(6,660)(COHNAM(L,J),J=1,4),(CBIOM(K,J),J=1,NFRELM),ABIOM(K)
     1,DRYM(K)
  650 CONTINUE
  660 FORMAT (5X, 4A4, 6X, 8F12.2)

C..........TOTALS ARE PRINTED
      IF(NFRACT.GT.1)GO TO 670
      WRITE (6,730) (ANIM(I,K),K=1,NFRELM),DRYMV(I)
      GO TO 680
  670 WRITE (6,730) (ANIM(I,K),K=1,NFRELM), ABIOSP(I),DRYMV(I)
  680 WRITE (6,700)
  690 CONTINUE
  700 FORMAT (1H )
      ORGDMT = ORGDMT + DRYMVO
      IF(NFRACT.GT.1)GO TO 710
      WRITE (6,720)(CBIOMA(K),K=1,NFRELM),DRYMVO
      GO TO 740
  710 WRITE (6,720)(CBIOMA(K),K=1,NFRELM),ABIOMA,DRYMVO
  720 FORMAT ('0TOTAL, ALL SPECIES', 8X, 8F12.2)
  730 FORMAT (10X, 'TOTAL',12X,8F12.2)

C..........POPULATION DATA ARE PRINTED
  740 WRITE (6,750)
  750 FORMAT ('0ANIMAL POPULATIONS, PER HECTARE')
      DO 780 I = 1, NSPECA
      K1 = 1
      IF (I.GT.1) K1 = NCOHCU(I-1) + 1
      K2 = NCOHCU(I)
      WRITE(6,580) (ASPNAM(I,J), J=1,7)
      IF(K2.GT.K1) GO TO760
      WRITE(6,620)  POP(K1)
      GO TO 780
  760 DO 770 K = K1, K2
      L=LISCOH(K)
  770 WRITE(6,660)(COHNAM(L,J),J=1,4),POP(K)
      WRITE (6,730) POPSP(I)
      WRITE (6,700)
  780 CONTINUE
C-----------------------------------------------------------------------
C      DATA FOR DEAD ORGANIC MATTER ARE PRINTED
C-----------------------------------------------------------------------
  790 ORGDMA = 0.
      IF (NOLIT.LE.0) GO TO 880
      WRITE (6,800)
  800 FORMAT('0CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HE
     1CTARE')
      WRITE (6,810) ((FRANAM(I,J), J = 1,7), I = 1,NFRELM)
```

```
000        IF(NFRACT.GT.1) WRITE(6,70)(BLANK,J=1,NFREL3),TOTNAM,TOTNAT      REPT2720
000       1     ,DRYMA1, DRYMA2, DRYMA3                                     REPT2730
000        IF(NFRACT.LE.1)WRITE(6,70)(BLANK,J=1,NFREL3),DRYMA1,DRYMA2,DRYMA3 REPT2740
000    810 FORMAT(5X,'TYPE OF MATERIAL',2X, 24A4)                           REPT2750
000
000 C..........DRY MATTER IS CALCULATED
000        DRYMVO = 0.                                                      REPT2760
000        DO860 I = 1, NOLIT                                               REPT2770
000        I7 = LITCAT(I)                                                   REPT2780
000        DRYMO = 0.                                                       REPT2790
000        DO 830 K = 1, NFRELM                                             REPT2800
000    820 DRYMO = DRYMO + CLIT(I,K) * DRYFAV(I7,K)                         REPT2810
000    830 CONTINUE                                                         REPT2820
000        DRYMVO = DRYMVO + DRYMO                                          REPT2830
000        IF(NFRACT.GT.1)GO TO 840                                         REPT2840
000
000 C..........INDIVIDUAL VALUES ARE PRINTED
000        WRITE (6,850) (ALINAM(I,J), J=1,6),(CLIT(I,J),J=1,NFRELM),DRYMO  REPT2850
000        GO TO 860                                                        REPT2860
000    840 WRITE (6,850) (ALINAM(I,J), J=1,6),(CLIT(I,J),J=1,NFRELM),ALIT(I),REPT2870
000       1DRYMO                                                            REPT2880
000    850 FORMAT (1X, 6A4,  2X, 8F12.2)                                    REPT2890
000    860 CONTINUE                                                         REPT2900
000        ORGDMA = ORGDMA + DRYMVO                                         REPT2910
000
000 C..........TOTALS ARE PRINTED
000        IF(NFRACT.GT.1)GO TO 870                                         REPT2920
000        WRITE (6,280) (CLITT(K),K=1,NFRELM),DRYMVO                       REPT2930
000        GO TO 880                                                        REPT2940
000    870 WRITE (6,280) (CLITT(K),K=1,NFRELM),ALITT,DRYMVO                 REPT2950
000 C-----------------------------------------------------------------------------
000 C      SOIL VALUES ARE PRINTED
000 C-----------------------------------------------------------------------------
000    880 WRITE (6,890)                                                    REPT2960
000    890 FORMAT ('0SOIL VARIABLES')                                       REPT2970
000        WRITE (6,900) ((FRANAM(I,J), J = 1,3), I = 1,NFRELM)             REPT2980
000        IF(NFRACT.GT.1) WRITE(6,70)(BLANK,J=1,NFREL3),TOTNAM,TOTNAT,    OREPT2990
000       1RGDM,ORGDM1,ORGDM2                                               REPT3000
000        IF(NFRACT.LE.1)WRITE(6,70)(BLANK,J=1,NFREL3),ORGDM,ORGDM1,      OREPT3010
000       1RGDM2                                                            REPT3020
000    900 FORMAT (31X, 24A4)                                               REPT3030
000        WRITE (6,910)                                                    REPT3040
000    910 FORMAT (' ORGANIC MATTER CONSTITUENTS')                          REPT3050
000        I7=3                                                             REPT3060
000
000 C..........ORGANIC DRY MATTER IS CALCULATED
000        DRYMVO = 0.                                                      REPT3070
000        DO 950 I = 1, NHORI7                                             REPT3080
000        DRYMO = 0.                                                       REPT3090
000        DO 920 K = 1, NFRELM                                             REPT3100
000    920 DRYMO = DRYMO + CORG(I,K) * DRYFAV (I7,K)                        REPT3110
000        I1 = I+1                                                         REPT3120
000        WRITE (6,410 ) HORDEP(I), HORDEP(I1)                             REPT3130
000
000 C..........INDIVIDUAL VALUES FOR ORGANIC MATTER ARE PRINTED
000        IF (NFRACT.GT.1) GO TO 930                                       REPT3140
000        WRITE (6,140) (CORG(I,K), K=1,NFRELM),DRYMO                      REPT3150
```

```
      GO TO 940
  930 WRITE (6,140) (CORG(I,K), K=1,NFRELM), AORG(I),DRYMO
  940 DRYMVO = DRYMVO + DRYMO
  950 CONTINUE
      ORGDMA = ORGDMA + DRYMVO
      IF (NHORIZ.LE.1) GO TO 970

C..........TOTALS FOR ORGANIC MATTER ARE PRINTED
      IF (NFRACT.GT.1) GO TO 960
      WRITE (6,230) (CORGH(I), I =1,NFRELM)            ,DRYMVO
      GO TO 970
  960 WRITE (6,230) (CORGH(I), I = 1, NFRELM), AORGH,DRYMVO
  970 WRITE (6,980)
  980 FORMAT (' IN MINERAL FRACTION')
      DO 990 I = 1,NHORIZ
      I1 = I + 1
      WRITE (6,410 ) HORDEP(I), HORDEP(I1)

C..........INDIVIDUAL VALUES FOR MINERAL ELEMENTS ARE PRINTED
  990 WRITE (6,140) (CMIN(I,K), K = 1, NELEMS)
      IF (NHORIZ.LE.1) GO TO 1000
      WRITE (6,280) (CMINH(I), I = 1,NELEMS)
C-----------------------------------------------------------------------
C     ECOSYSTEM TOTALS ARE PRINTED
C-----------------------------------------------------------------------
 1000 WRITE (6,1010)
 1010 FORMAT ('0TOTAL, SOIL AND DEAD')
      ORGDMT = ORGDMT + ORGDMA
      IF (NFRACT.GT.1) GO TO 1020
      WRITE (6,1030) (TOT  (K), K=1,NFRELM),ORGDMA
      GO TO 1040
 1020 WRITE (6,1030) (TOT(K), K = 1,NFRELM), ATOT,ORGDMA
 1030 FORMAT(5X, 'ORGANIC MATERIAL',   6X, 8F12.2)
 1040 IF (NFRACT.GT.1) GO TO 1050
      WRITE (6,1060) (TOTAL(K), K=1,NFRELM),ORGDMT
      GO TO 1070
 1050 WRITE (6,1060) (TOTAL(K), K=1,NFRELM), ATOTO,ORGDMT
 1060 FORMAT (   '0TOTAL IN ECOSYSTEM', 8X, 8F12.2)
 1070 IF (NCHECK.LE.0) GO TO 1190
C-----------------------------------------------------------------------
C     NET ECOSYSTEM GAINS AND LOSSES ARE PRINTED
C-----------------------------------------------------------------------
 1080 WRITE (6,1090)
 1090 FORMAT (///'0ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM')
      WRITE (6,1100)      ((FRANAM(K,J),J=1,3),K=1,NELEM)
 1100 FORMAT (37X,'WATER    MINERAL SOIL    ', 18A4)
      IF (NFRACT.GT.1) GO TO 1110
      WRITE (6,1120)(BLANK,J=1,NELEM3),(FRANAM(NFRELM,J),J=1,3)
      GO TO 1130
 1110                   WRITE(6,1120)(BLANK, J=1,NELEM3), TOTNAM,TOTNAT
 1120 FORMAT ('+', 63X, 18A4)
 1130 J = NELEM
      IF (NFRACT.GT.1) J = J + 1
      DO 1140 I = 1,NCHAN
 1140 WRITE(6,1150)(SOURCE(L,I),L=1,6),H2O(I),EROD(I),(AGAIN(I,L),L=1,J)
 1150 FORMAT (2X, 6A4,2F16.2, 6F12.2)
      H2OTOT = 0.
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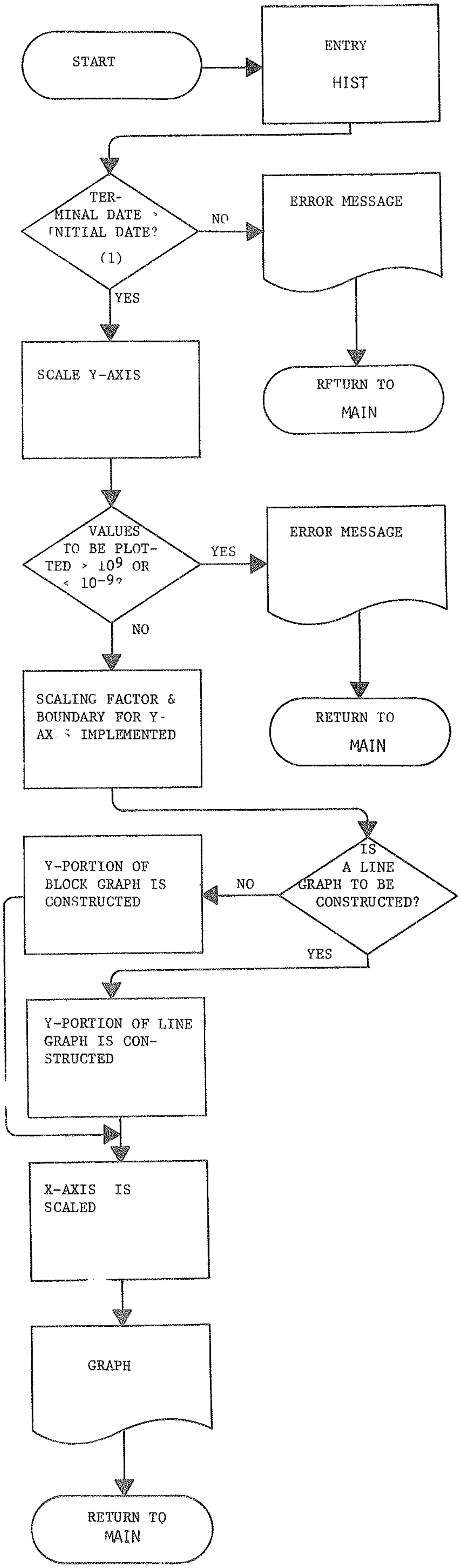
000        FROTOT = 0.                                                        REPT3540
000        DO 1160 I = 1, J                                                   REPT3550
000   1160 AGAINT(I) = 0.                                                     REPT3560
000        DO 1170 I = 1,NCHAN                                                REPT3570
000        H2OTOT = H2OTOT + H2O(I)                                           REPT3580
000        FROTOT = FROTOT + FROD(I)                                          REPT3590
000        DO 1170 K = 1, J                                                   REPT3710
000   1170 AGAINT(K) = AGAINT(K) + AGAIN (I,K)                                REPT3720
000        WRITE (6,1180) H2OTOT, FROTOT, (AGAINT(K), K=1,J)                  REPT3730
000   1180 FORMAT ('0          TOTAL', 12X, 2F16.2, 8F12.2)                   REPT3740
000   C-------------------------------------------------------------------------
000   C        WATER DATA ARE PRINTED
000   C-------------------------------------------------------------------------
000   1190 WRITE (6,1210)                                                     REPT3760
000        DO 1200 I = 1, NHORIZ                                              REPT3760
000        I1 = I+ 1                                                          REPT3770
000        WRITE (6,410) HORDEP(I), HORDEP(I1)                                REPT3780
000   1200 WRITE (6,140) WATER(I)                                             REPT3790
000   1210 FORMAT ('0SOIL WATER POTENTIAL, ATM.')                             REPT3800
000   1230 IF (SNODEP.GT.0.) WRITE (6,1240) SNODEP,SNOCOV                     REPT3850
000   1240 FORMAT ('0',14X,'SNOW COVER =', F7.1,' MM., OR',-6PF8.1,
000       1 'TONS PER HECTARE')
000        IF (FREWAT.GT.0.) WRITE (6,1250) FREWAT
000   1250 FORMAT ('0', 14X, 'FREE WATER DEPTH =', F7.1,' MM.')
000        IF (JSTATE.LE.0) RETURN
000        WRITE (6,1260)
000   1260 FORMAT ('0ADDITIONAL STATE VARIABLES')
000        WRITE (6,1270)(DUMMY(I), I = 1,25)
000   1270 FORMAT (1H , 8F15.5)
000        RETURN                                                             REPT3880
000        END                                                                REPT3890
```

FLOW CHART OF GRAF



(1) TERMINAL DATE OF SIMULATION GREATER THAN INITIAL DATE OF SIMULATION?

GRAF

PROGRAM LISTING

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000    C      WHEN CALLED AS GRAF , THIS SUBROUTINE RECEIVES IN EACH ROW OF THE      8280
000    C      ARRAY FIGS THE 70 VALUES OF Y REQUIRED FOR SUCCESSIVE VALUES OF X,     8290
000    C      EQUALLY SPACED BETWEEN XMIN AND XMA.   THE MINIMUM AND MAXIMUM         8300
000    C      VALUES OF Y ARE TRANSFERRED AS YMIN, YMAX.    THE NUMBER OF ROWS      8310
000    C      OF FIGS USED (I.E. THE NUMBER OF CURVES REQUIRED ON THE GRAPH) IS      8320
000    C      TRANSFERRED AS NOSYM.     THE TITLE FOR THE GRAPH IS TRANSFERRED AS    8330
000    C      TITLE, THAT FOR THE Y AXIS AS YTITLE.                                  8340
000    C      THE MEANINGS OF THE DIFFERENT GRAPHS ARE TRANSFERRED (IN ORDER) IN     8350
000    C      THE SUCCESSIVE COLUMNS OF EXPLAN.   ENTRY HIST PRODUCES A BLOCK
000    C      GRAPH WITH NOCOL COLUMNS EQUALLY SPACED BETWEEN XMIN AND XMA, THE      8370
000    C      VALUE FOR EACH COLUMN BEING TRANSFERRED IN XDOT.
000
000    C THE FOLLOWING ARE DEFINITIONS OF VARIABLES NOT COMMON TO THE MAIN
000    C PROGRAM.   VARIABLES USED ONLY FOR TEMPORARY PURPOSES ARE OMITTED.
000
000    C A                THE RANGE OF X VALUES
000    C ANUM(I)          STORAGE FOR DIGIT SYMBOLS
000    C APOS             STORED VERTICAL LINE ('I') FOR VERTICAL BOUNDARY OF GRAPH
000    C                  OF GRAPH
000    C B                THE RANGE OF Y VALUES
000    C BLANK            A STORED BLANK FOR USE IN OUTPUT
000    C FMT1(I)          FORMAT FOR Y AXIS SCALE HEADING
000    C GRAPH(I,J)       SYMBOLS STORED, ONE PER WORD, TO FORM THE OUTPUT
000    C                  GRAPH
000    C HYPHEN           A STORED HYPHEN ('-') FOR USE IN OUTPUT
000    C IDAYS(K)         DATE IN THE YEAR FOR MARKERS ALONG THE X AXIS
000    C IEND             THE LAST COLUMN - IN THIS IMPLEMENTATION ALWAYS 71
000    C INDEX            A SWITCH DETERMINED BY THE ENTRY POINT, 1 FOR LINE
000    C                  GRAPHS, 3 FOR BLOCK GRAPHS
000    C INTERV           THE COLUMN INTERVAL - IN THIS IMPLEMENTATION, ALWAYS
000    C                  UNITY
000    C ISTART           THE FIRST COLUMN - IN THIS IMPLEMENTATION, ALWAYS 1
000    C IYEARS(K)        NUMBER OF YEAR FOR MARKERS ALONG THE X AXIS
000    C I102             EXPONENT OF MULTIPLYING FACTOR FOR Y AXIS
000    C PLUS             A STORED PLUS SIGN ('+') FOR USE IN OUTPUT
000    C SMALL            A SMALL REAL NUMBER TO SERVE AS POSITIVE AND NEGATIVE
000    C                  LIMITS OF THE Y AXIS WHERE Y IS ALWAYS ZERO
000    C STAR             A STORED ASTERISK ('*') FOR USE IN BLOCK GRAPHS
000    C SYMBOL(I)        STORED ALPHABETICAL SYMBOLS FOR LINE GRAPHS
000    C XLINE(I)         STORAGE FOR THE HORIZONTAL BOUNDARY OF THE GRAPH
000    C XUNIT            INCREMENT OF X PER COLUMN
000    C YAXIS(K)         VALUE OF Y AT MARKER POINTS ON Y AXIS
000    C YUN              PRINTER LINES PER UNIT OF Y
000    C YUNIT            INCREMENT OF Y PER PRINTER LINE
000
000           SUBROUTINE GRAF                                                        8270
000    C--------------------------------------------------------------------------
000    C      COMMON BLOCK /DIAGR/ CONTAINS INFORMATION REQUIRED FOR GRAPHS.
000    C--------------------------------------------------------------------------
000           COMMON/DIAGR/FIGS(8,70),EXPLAN(5,8),TITLE(20),YTITLE(10),
000          1 XDOT(71), XMAX, XMIN, YMAX, YMIN, NOSYM, INITYR
000           DIMENSION FMT1(7),SYMBOL(8),GRAPH(51,71), ANUM(10)
000          1 ,YAXIS(6), XLINE(18), IDAYS(8), IYEARS(8)
000           DATA XLINE/'+---','----','--+-',2*'----','+---','----','--+-',         8440
000          1 2*'----','+---','----','--+-',2*'----','+---','----','--+ '/          8450
```

```
000          DATA ANUM /'0','1','2','3','4','5','6','7','8','9'/                 8460
000          DATA FMT1/'(1H+',',',' ',' ','PF18','.4,8','0A1)'/                   8470
000          DATA BLANK /' '/ STAR /'*'/  SMALL/1.E-8/                           8490
000          DATA APOS/'I' /  PLUS/'+'/ HYPHEN /'-'/                             8500
000          DATA SYMBOL/'A','B','C','D','E','F','G','H'/                        8510
000          DATA /INTERV/1/, ISTART/1/, IEND/71/, NOCOL/71/
000          INDEX = 1                                                           8530
000          GO TO 655                                                           8540
000          ENTRY HIST                                                          8550
000          NOSYM = 0                                                           8560
000          INDEX = 3                                                           8570
000      655 FMT1(4) = BLANK                                                     8610
000          FMT1(3) = BLANK                                                     8620
000    C---------------------------------------------------------------------
000    C     IF THE LIMITS OF THE X AXIS ARE EQUAL, AN ERROR MESSAGE RESULTS.
000    C     IF THE LIMITS OF THE Y AXIS ARE BOTH ZERO, THEY ARE SEPARATED.
000    C---------------------------------------------------------------------
000          IF (XMAX.GT.XMIN) GO TO 101
000          WRITE (6,10)
000          RETURN
000       10 FORMAT ('1NO GRAPH POSSIBLE BECAUSE NO TIME SIMULATED')
000      101 IF (YMAX.NE.YMIN) GO TO 102                                         8690
000          IF (YMAX.NE.0.) GO TO 1101                                          8700
000          YMAX = SMALL                                                        8710
000          YMIN = - SMALL                                                      8720
000          GO TO 102                                                           8730
000     1101 YMAX = YMAX * 1.001                                                 8740
000          YMIN = YMIN * .999                                                  8750
000      102 DO 938 I = 1, 51                                                    8760
000          DO 937 J = 1, 71                                                    8770
000      937 GRAPH(I,J) = BLANK                                                  8780
000      938 CONTINUE                                                            8790
000          B = AMAX1(ABS(YMIN), ABS(YMAX))                                     8800
000          I = 0                                                               8820
000          A = XMAX - XMIN
000          IF ((A.GT.0.).AND.(B.GT.0.).AND.(YMAX.GE.YMIN)) GO TO 383
000          WRITE (6,5376) XMAX, XMIN, YMAX, YMIN                               8850
000     5376 FORMAT ('0ERROR IN LIMITS:', 4E20.6)                                8860
000          RETURN
000    C---------------------------------------------------------------------
000    C     THE Y AXIS IS SCALED.
000    C---------------------------------------------------------------------
000      383 IF (B.GE.1.) GO TO 381                                              9020
000          B = B * 10.                                                         9030
000          I = I - 1                                                           9040
000          GO TO 383                                                           9050
000      381 IF (B.LT.10.) GO TO 382                                             9060
000          B = B * .1                                                          9070
000          I = I + 1                                                           9080
000          GO TO 381                                                           9090
000      382 I102 = I                                                            9100
000          J = IABS(I)                                                         9110
000          IF (J.LE.9) GO TO 2291                                              9120
000    C---------------------------------------------------------------------
000    C     IF THE VALUES TO BE GRAPHED EXCEED PERMISSIBLE LIMITS, AN ERROR
000    C     MESSAGE RESULTS.
000    C---------------------------------------------------------------------
```

```
000          WRITE (6,301) (TITLE(K), K=1,20)                                  9130
000          WRITE (6,2292)                                                    9140
000     2292 FORMAT ('DFACTOR FOR Y AXIS .GT. 10**9 OR .LT. 10**-9')           9150
000          RETURN                                                            9160
000   C-----------------------------------------------------------------------
000   C      THE APPROPRIATE SCALING FACTOR IS INSERTED IN THE FORMAT FOR
000   C      THE Y AXIS.
000   C-----------------------------------------------------------------------
000     2291 IF (I.LF.0) GO TO 393                                             9170
000          FMT1(3) = HYPHEN                                                  9180
000      393 FMT1(4)      = ANUM(J+1)                                          9190
000   C-----------------------------------------------------------------------
000   C      THE Y BOUNDARY OF THE GRAPH IS INSERTED.
000   C-----------------------------------------------------------------------
000          DO 1 I = 1, 51                                                    9200
000        1 GRAPH(I,1) = APOS                                                 9210
000          DO 3 I = 1,51,10                                                  9220
000        3 GRAPH(I,1) = PLUS                                                 9230
000          YUNIT = 50./(YMAX-YMIN)                                           9240
000          XUNIT= 70./(XMAX - XMIN)                                          9250
000          GO TO (901,902 , 903            ), INDEX                          9260
000      902 WRITE (6,911)                                                     9270
000      911 FORMAT ('0DOT DIAGRAM FACILITY NOT AVAILABLE')                    9280
000          RETURN                                                            9290
000   C-----------------------------------------------------------------------
000   C      THE BLOCK GRAPH IS CONSTRUCTED.
000   C-----------------------------------------------------------------------
000      903 Y = YMIN                                                          9300
000          YUN = 1./YUNIT                                                    9310
000          DO 921 I = 1, 51                                                  9320
000          DO 811 K = 2, NOCOL                                               9330
000          IF (XDOT(K).GE.Y) GRAPH(I,K) = STAR
000      811 CONTINUE                                                          9380
000          Y = Y + YUN                                                       9390
000      921 CONTINUE                                                          9400
000          GO TO 912                                                         9410
000   C-----------------------------------------------------------------------
000   C      THE LINE GRAPH IS CONSTRUCTED.
000   C-----------------------------------------------------------------------
000      901 DO 34 I = 1, NOSYM                                                9420
000          DO 5 J = 1, 70                                                    9430
000          K = (FIGS(I,J) - YMIN)*YUNIT+ .1                                  9440
000          IF (K.GT.50) GO TO 5                                              9450
000          GRAPH(K+1,J+1)= SYMBOL(I)                                         9460
000        5 CONTINUE                                                          9470
000       34 CONTINUE                                                          9480
000      912 XUNIT = (XMAX - XMIN)/7.                                          9490
000   C-----------------------------------------------------------------------
000   C      THE X AXIS IS SCALED.
000   C-----------------------------------------------------------------------
000          IDAYS(1) = XMIN
000          IYEARS(1) = INITYR
000          DO 16 I = 2,8
000       16 IDAYS(I) = XMIN + XUNIT * FLOAT(I-1)
000          DO 6 I = 2,8
000          IYEARS(I) = IYEARS(I-1)
000       11 NYRDAY = 365
```

```
      IF (MOD(IYEARS(I),4).EQ.0) NYRDAY = 366
      IF (IDAYS(I).LE.NYRDAY) GO TO 6
      IYEARS(I) = IYEARS(I) + 1
      DO 15 J=I,8
   15 IDAYS(J) = IDAYS(J) - NYRDAY
      GO TO 11
    6 CONTINUE
      YUNIT = (YMAX - YMIN )/5.                                    9530
      YAXIS(1) = YMAX                                              954C
      DO 7 J = 2, 6                                                9550
    7 YAXIS(J) = YAXIS(J-1) - YUNIT                                9560
C-----------------------------------------------------------------------
C     THE GRAPH IS PRINTED.
C-----------------------------------------------------------------------

C..........HEADINGS ARE PRINTED
      WRITE (6,301) (TITLE(I), I = 1, 20)                          9570
  301 FORMAT (1H1, 20A4)                                           9580
      IF (NOSYM.GT.1)WRITE(6,1011)SYMBOL(1),(EXPLAN(I,1),I=1,5)    9590
      WRITE (6,1021)                                               9600
 1021 FORMAT (1H )                                                 9610
      IF (NOSYM.GT.1)WRITE(6,1011)SYMBOL(2),(EXPLAN(I,2),I=1,5)    9620
 1011 FORMAT (1H+, 95X, 6A4)                                       9660
      WRITE (6,303) I102, (YTITLE(I), I = 1,10)                    9670
  303 FORMAT ('  Y AXIS (*10**',I2,') IS ',10A4)                   9680
      IF (NOSYM.GT.2) WRITE(6,1011) SYMBOL(3),(EXPLAN(I,3),I=1,5)

C..........THE GRAPH ITSELF IS PRINTED.
 1012 J = 1                                                        9720
      I3 = 3
      DO 21 I1= 1, 51                                              9740
      I3 = I3 + 1                                                  9750
      I = 52 - I1                                                  9760
      WRITE (6,9) (GRAPH(I,K), K = 1, 71)                          9770
    9 FORMAT (20X, 71A1)
      IF (I-I/10*10.NE.1) GO TO 121                                9780
      WRITE (6,FMT1) YAXIS(J)                                      9790
      J = J + 1                                                    9800
  121 IF(I3.LE.NOSYM)WRITE(6,1011)SYMBOL(I3),(EXPLAN(K,I3),K=1,5)  9810
   21 CONTINUE                                                     9820
      WRITE (6,89) (XLINE(I), I = 1,18)                            9830
   89 FORMAT (20X, 18A4)                                           9840
      WRITE (6,12) (IDAYS(I), I = 1,8)
   12 FORMAT ('   TIME - DAY    ', I5, 7(6X, I4))
      WRITE (6,13) (IYEARS(I), I = 1,8)
   13 FORMAT (9X,'YEAR     ', I5, 7(6X,I4))
      RETURN                                                       9870
      END                                                          9880
```

INPUT/OUTPUT EXAMPLE

A listing of a set of input cards follows, with the resulting output, using the third versions of the sub-routines VEGET, ANIMAL and SOILS. For each input card, the number of the input statement by which it is read is indicated.

```
                                                                              INPUT STATEMENT
                                                                                  NUMBER
   THESF DATA ARE DERIVED FROM BIOME PROGPESS REPORTS FOR DATA YEAR 1971       MAIN 465
   NOT ALL OF THE DATA WERE AVAILABLE AT THE TIME OF THIS SIMULATION, THUS     MAIN 465
   MANY STATE VARIABLE VALUES AND PARAMETEP VALUES HAD TO BE DEDUCED.          MAIN 465
                                                                               MAIN 465
 ROCK VALLEY -- ZONE 20                                                        MAIN 482
    10    1    8    3    2   10    2    r    3    1    7 1000                  MAIN 491/2
   344 1970  541    2    6    1                                                MAIN 493
   465  495                                                                    MAIN 500
     0    0    1    0    0                                                     MAIN 502/3
     2                                                                         MAIN 578
 LYCIUM ANDERSONII           KRAMERIA PARVIFOLIA                               MAIN 609
 LARREA TRIDENTATA           EPHEDRA NEVADENSIS                                MAIN 609
 AMBROSTA DUMOSA             GRAYIA SPINOSA                                    MAIN 609
 LYCIUM PALLIDUM             EUROTIA LANATA                                    MAIN 609
 OTHER PERENNIALS            ANNUALS                                           MAIN 609
 DIPODOMYS MERPIAMI                                                            MAIN 611
 LEAVES                  YOUNG STEMS              OLDER STEMS AND BASES        MAIN 613
 INFLORESCENCES          SEEDS                    ROOTS 0-6 CM                 MAIN 613
 ROOTS 6-20 CM           ROOTS 20-70 CM                                        MAIN 613
 NITROGEN    ASH ELEM.   PROTEIN C   RESERVE C    OTHER C                      MAIN 619
 ADULT           JUVENILE                                                      MAIN 622
 HERB. STANDING DEAD     WOODY STANDING DEAD      HERB. LITTER                 MAIN 622
 WOODY LITTER            SOFT ANIM. PARTS         SKELETONS                    MAIN 622
 EXCRETA,SURFACE         DEAD ROOTS 0-6CM         DEAD ROOTS 6-20CM            MAIN 622
 DEAD ROOTS 20-70CM                                                            MAIN 622
     1    1    1    1    2    2    2    1    1    1                            MAIN 626
 1.          1.          1.68        2.2         2.2                           MAIN 628
 0.0         1.0         1.858       1.316       1.629                         MAIN 628
 1.0         1.0         1.5         2.5         2.5                           MAIN 628
     1    2    3    7    8   10                                                MAIN 633
    60.       200.        700.                                                 MAIN 638
                                                                               MAIN 654
                                                                               MAIN 654
   10108.40  40433.60  31588.75  22973.64 155072.04                            MAIN 654
                                                                               MAIN 654
                                                                               MAIN 654
     741.20   2964.80   2316.25   1684.55  11370.68                            MAIN 654
    4940.00  19760.00  15437.50  11227.27  75784.09                            MAIN 654
    6670.00  26680.00  20843.75  15159.09 102323.86                            MAIN 654
                                                                               MAIN 654
                                                                               MAIN 654
    5766.60  23066.40  18020.62  13105.91  88464.89                            MAIN 654
                                                                               MAIN 654
                                                                               MAIN 654
     422.00   1688.00   1318.75    959.09   6473.86                            MAIN 654
    2816.00  11264.00   8800.00   6400.00  43200.00                            MAIN 654
    3804.00  15216.00  11887.50   8645.45  58356.82                            MAIN 654
     250.00    800.00    781.25   1909.09   1562.50                            MAIN 654
                                                                               MAIN 654
    5016.20  20064.80  15675.62  11400.45  76953.07                            MAIN 654
                                                                               MAIN 654
                                                                               MAIN 654
     366.00   1464.00   1143.75    831.82   5614.77                            MAIN 654
    2444.00   9776.00   7637.50   5554.55  37493.18                            MAIN 654
    3298.00  13192.00  10306.25   7495.45  50594.32                            MAIN 654
```

000056						MAIN	654
000057						MAIN	654
000058	1752.20	7008.80	5475.62	3982.27	26880.34	MAIN	654
000059						MAIN	654
000060						MAIN	654
000061	128.40	513.60	401.25	291.82	1969.77	MAIN	654
000062	860.00	3440.00	2687.50	1954.55	13193.18	MAIN	654
000063	1154.00	4616.00	3606.25	2622.73	17703.41	MAIN	654
000064						MAIN	654
000065						MAIN	654
000066	1266.20	5064.80	3956.87	2877.73	19474.66	MAIN	654
000067						MAIN	654
000068						MAIN	654
000069	92.80	371.20	290.00	210.91	1423.64	MAIN	654
000070	618.00	2472.00	1931.25	1404.55	9480.68	MAIN	654
000071	834.00	3336.00	2606.25	1895.45	12794.32	MAIN	654
000072						MAIN	654
000073						MAIN	654
000074	394.80	1579.20	1233.75	897.27	6056.59	MAIN	654
000075						MAIN	654
000076						MAIN	654
000077	28.94	115.76	90.44	65.77	443.97	MAIN	654
000078	192.80	771.20	602.50	438.18	2957.73	MAIN	654
000079	260.40	1041.60	813.75	591.82	3994.77	MAIN	654
000080						MAIN	654
000081						MAIN	654
000082	359.40	1437.60	1123.12	816.82	5513.52	MAIN	654
000083						MAIN	654
000084						MAIN	654
000085	27.60	110.40	86.25	62.73	423.41	MAIN	654
000086	175.60	702.40	548.75	399.09	7693.86	MAIN	654
000087	237.00	948.00	740.62	538.64	3635.80	MAIN	654
000088	.5	1.6	1.5	4.0	3.0	MAIN	654
000089						MAIN	654
000090	66.00	264.00	206.25	150.00	1012.50	MAIN	654
000091						MAIN	654
000092						MAIN	654
000093	4.80	19.20	15.00	10.91	73.64	MAIN	654
000094	32.20	128.80	100.62	73.18	493.98	MAIN	654
000095	43.40	173.60	135.62	98.64	665.80	MAIN	654
000096						MAIN	654
000097						MAIN	654
000098	33.	132.	103.	75.	506.	MAIN	654
000099						MAIN	654
000100						MAIN	654
000101	2.4	9.6	7.5	5.5	36.8	MAIN	654
000102	16.	64.	50.	37.	247.	MAIN	654
000103	22.	87.	68.	49.	333.	MAIN	654
000104						MAIN	654
000105						MAIN	654
000106						MAIN	654
000107						MAIN	654
000108						MAIN	654
000109						MAIN	654
000110						MAIN	654
000111						MAIN	654
000112	30.00	30.00	90.00	144.00	32.73	MAIN	660

```
000113        70.00     70.00    210.00    336.00     76.36          MAIN 660
000114        80.00     80.00    240.00    384.00     87.27          MAIN 660
000115      1000.00   1000.00   3000.00   4800.00   1090.91          MAIN 660
000116        10.00     10.00     30.00     48.00     10.91          MAIN 660
000117        10.00     10.00     30.00     48.00     10.91          MAIN 660
000118        10.00     10.00     30.00     48.00     10.91          MAIN 660
000119        10.00     10.00     30.00     48.00     10.91          MAIN 660
000120        10.00     10.00     30.00     48.00     10.91          MAIN 660
000121        10.00     10.00     30.00     48.00     10.91          MAIN 660
000122         0.92                                                  MAIN 668
000123    0.832     1.438     1.896     6.0 3     1.512              MAIN 672
000124  NFW                                                          MAIN 672
000125        40.00    800.00    125.00     90.91   3977.27          MAIN 678
000126    28.46     56.92     87.64     63.74      27.89             MAIN 678
000127         8.00    160.00     25.00     18.18    795.45          MAIN 678
000128       140.00   2800.00    437.50    318.18  13920.45          MAIN 678
000129       240.00    480.00   1200.00   1200.00   9600.00          MAIN 678
000130        24.00     48.00    120.00    120.00    960.00          MAIN 678
000131       240.00    480.00   1200.00   1200.00   9600.00          MAIN 678
000132       205.60   4112.00    642.50    467.27  20443.18          MAIN 678
000133      1370.80  27416.00   4283.75   3115.45 136301.13          MAIN 678
000134      1850.00  37000.00   5781.25   4204.55 183948.86          MAIN 678
000135    130400.   652000.   326000.   326000.   2608000.           MAIN 682
000136    180000.    77000.      4.8                                 MAIN 683
000137    134400.   672000.   336000.   336000.   2688000.           MAIN 682
000138     74000.   171000.     12.0                                 MAIN 683
000139    428000.   2140000.  1070000.  1070000.  8560000.           MAIN 682
000140    188000.    505000.    50.0                                 MAIN 683
000141                                                               MAIN 684
000142    10247102621029210307103 22                                 MAIN 884
000143    BIOMASS OF ANNUALS, BY ORGAN                               MAIN 891
000144    TOTAL CARBON (G. PER HA.)                                  MAIN 892
000145    LEAVES                                                     MAIN 895
000146    YOUNG STEMS                                                MAIN 895
000147    INFLORESCENCES                                             MAIN 895
000148    SEEDS                                                      MAIN 895
000149    ROOTS 0-6CM                                                MAIN 895
000150    10238102391024010242102 43                                 MAIN 884
000151    LEAF BIOMASS OF SHRUBS, BY SPECIES                         MAIN 891
000152    TOTAL CARBON (G. PER HA.)                                  MAIN 892
000153    LYCIUM                                                     MAIN 895
000154    KRAMERIA                                                   MAIN 895
000155    LARREA                                                     MAIN 895
000156    AMBROSIA                                                   MAIN 895
000157    GRAYIA                                                     MAIN 895
000158    10283102841028510287102 88                                 MAIN 884
000159    SEED BIOMASS OF SHRUBS, BY SPECIES                         MAIN 891
000160    TOTAL CARBON (G. PER HA.)                                  MAIN 892
000161    LYCIUM                                                     MAIN 895
000162    KRAMERIA                                                   MAIN 895
000163    LARREA                                                     MAIN 895
000164    AMBROSIA                                                   MAIN 895
000165    GRAYIA                                                     MAIN 895
000166    20007                                                      MAIN 884
000167    EXCHANGE OF CARBON WITH ATMOSPHERE(+ INPUT FROM, - OUTPUT TO)  MAIN 891
000168    GRAMS PER HECTARE                                          MAIN 892
000169    01649016520 1655                                           MAIN 884
```

```
000170   PERCENTAGE SATURATION OF SOIL(V/V BASIS)                         MAIN 891
000171   FRACTION OF HORIZON WIDTH              ZERO                      MAIN 892
000172   0-6 CM                                                           MAIN 895
000173   6-20 CM                                                          MAIN 895
000174   20-70 CM                                                         MAIN 895
000175   20016 20017                                                      MAIN 884
000176   WATER FXCHANGE WITH ATMOSPHFRE AND SURFACE LOSS                  MAIN 891
000177   GRAMS WATER PER HECTARF                                          MAIN 892
000178   ATMOSPHFRE                                                       MAIN 895
000179   SURFACF                                                          MAIN 895
000180   20007                                                            MAIN 884
000181   EXCHANCE OF CARBON WITH ATMOSPHERE(+ INPUT FROM, - OUTPUT TO)    MAIN 891
000182   GRAMS PFR HECTARE                                                MAIN 892
```

[At this point, NAMELIST input required by the process subroutines (q.v.) is read in]

```
000496                                                                                    EXOGEN 136
000497                                                                                    EXOGEN 137
000498                                                                                    EXOGEN 141
000499                                                                                    EXOGEN 145
000500    36   45   52   60   61   67  128  129  133  135  136  215  239  320  328 1971   EXOGEN 151
000501    .4  7.6   .1  1.0   .2   .1 10.0  7.3   .5  1.2   .3 10.0 23.4   .3   .4 1971   EXOGEN 182
000502   333  338  350  357  358  360  361  363                                    1971   EXOGEN 151
000503    .1   .4   .3  5.0 12.2 11.5  6.2  5.0                                    1971   EXOGEN 182
000504                                                                                    EXOGEN 151
000505                                                                                    EXOGEN 204
000506    24.       24.       30.       30.       34.       42.       46.       45.         EXOGEN 274
000507     43.       36.      21.        16.                                              EXOGEN 274
000508    -4.       -9.      -11.       -4.       1.        1.        16.       17.         EXOGEN 275
000509    4.        -5.      -5.        -7.                                               EXOGEN 275
000510    1.        2.        3.       4.16       5.83      7.98      9.        7.36        EXOGEN 276
000511    5.38      2.18      2.        1.                                                EXOGEN 276
```

000512	11.	12.	13.	14.	15.	16.	15.5	14.	EXOGEN	277
000513	13.	12.	11.	10.5					EXOGEN	277
000514	.15	.17	.28	.33	.39	.47	.45	.39	EXOGEN	278
000515	.33	.28	.17	.15					EXOGEN	278
000516	3.	2.	3.	3.	4.	5.	4.	6.	EXOGEN	279
000517	6.	4.	4.	3.					EXOGEN	279
000518	1.	2.	4.	5.	3.	7.	5.	4.	EXOGEN	280
000519	2.	5.	4.	2.					EXOGEN	280
000520	10.	10.	15.	10.	20.	15.	15.	20.	EXOGEN	281
000521	25.	10.	10.	10.					EXOGEN	281

OCK VALLEY -- ZONE 20

NITIAL REPORT ON DEC 10 1970

ONSTITUENTS OF VEGETATIONAL BIOMASS, G. OR KCAL. PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
YCIUM ANDERSONII							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	10108.40	40433.60	31588.75	22973.64	155072.04	209634.43	495311.59
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	741.20	2964.80	2316.25	1684.55	11370.68	15371.48	36318.81
ROOTS 6-20 CM	4940.00	19760.00	15437.50	11227.27	75784.09	102448.86	242059.99
ROOTS 20-70 CM	6670.00	26680.00	20843.75	15159.09	102323.86	138326.70	326829.98
TOTAL	22459.60	89838.40	70186.25	51044.55	344550.67	465781.46	1100520.36
RAMERIA PARVIFOLIA							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	5766.60	23066.40	18020.62	13105.91	88464.89	119591.42	282563.40
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	422.00	1688.00	1318.75	959.09	6473.86	8751.70	20677.99
ROOTS 6-20 CM	2816.00	11264.00	8800.00	6400.00	43200.00	58400.00	137984.00
ROOTS 20-70 CM	3804.00	15216.00	11887.50	8645.45	58356.82	78889.77	186395.99
TOTAL	12808.60	51234.40	40026.87	29110.45	196495.57	265632.89	627621.37
RREA TRIDENTATA							
LEAVES	250.00	800.00	781.25	1909.09	1562.50	4252.84	10000.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	5016.20	20064.80	15675.62	11400.45	76953.07	104029.14	245793.78
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	366.00	1464.00	1143.75	831.82	5614.77	7590.34	17934.00
ROOTS 6-20 CM	2444.00	9776.00	7637.50	5554.55	37493.18	50685.23	119756.00
ROOTS 20-70 CM	3298.00	13192.00	10306.25	7495.45	50594.32	68396.02	161601.99
TOTAL	11374.20	45296.80	35544.37	27191.36	172217.84	234953.57	555085.77
HEDRA NEVADENSIS							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	1752.20	7008.80	5475.62	3982.27	26880.34	36338.23	85857.78
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	128.40	513.60	401.25	291.82	1969.77	2662.84	6291.60
ROOTS 6-20 CM	860.00	3440.00	2687.50	1954.55	13193.18	17835.23	42140.01
ROOTS 20-70 CM	1154.00	4616.00	3606.25	2622.73	17703.41	23932.39	56546.01
TOTAL	3894.60	15578.40	12170.62	8851.37	59746.70	80768.69	190835.39
BROSIA DUMOSA							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	1266.20	5064.80	3956.87	2877.73	19424.66	26259.26	62043.80
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	92.80	371.20	290.00	210.91	1423.64	1924.55	4547.21
ROOTS 6-20 CM	618.00	2472.00	1931.25	1404.55	9480.68	12816.48	30282.01
ROOTS 20-70 CM	834.00	3336.00	2606.25	1895.45	12794.32	17296.02	40865.99
TOTAL	2811.00	11244.00	8784.37	6388.64	43123.30	58296.31	137739.01
AYIA SPINOSA							

LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	394.80	1579.20	1233.75	897.27	6056.59	8187.61	19345.19
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	28.94	115.76	90.44	65.77	443.97	600.18	1418.07
ROOTS 6-20 CM	192.80	771.20	602.50	438.18	2957.73	3998.41	9447.20
ROOTS 20-70 CM	260.40	1041.60	813.75	591.82	3994.77	5400.34	12759.60
TOTAL	876.94	3507.76	2740.44	1993.04	13453.06	18186.54	42970.06
.YCIUM PALLIDUM							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	359.40	1437.60	1123.17	816.82	5513.52	7453.46	17610.59
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	27.60	110.40	86.25	62.73	423.41	572.39	1352.41
ROOTS 6-20 CM	175.60	702.40	548.75	399.09	2693.86	3641.70	8604.39
ROOTS 20-70 CM	237.00	948.00	740.62	538.64	3635.80	4915.06	11613.01
TOTAL	799.60	3198.40	2498.74	1817.28	12266.59	16582.61	39180.40
:UROTIA LANATA							
LEAVES	.50	1.60	1.50	4.00	3.00	8.50	20.02
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	66.00	264.00	206.25	150.00	1012.50	1368.75	3234.00
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	4.80	19.20	15.00	10.91	73.64	99.55	235.21
ROOTS 6-20 CM	32.20	128.80	100.62	73.18	493.98	667.78	1577.79
ROOTS 20-70 CM	43.40	173.60	135.62	98.64	665.80	900.06	2126.61
TOTAL	146.90	587.20	458.99	336.73	2248.92	3044.64	7193.63
THER PERENNIALS							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	33.00	132.00	103.00	75.00	506.00	684.00	1616.24
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	2.40	9.60	7.50	5.50	36.80	49.80	117.66
ROOTS 6-20 CM	16.00	64.00	50.00	37.00	247.00	334.00	788.80
ROOTS 20-70 CM	22.00	87.00	68.00	49.00	333.00	450.00	1063.64
TOTAL	73.40	292.60	228.50	166.50	1122.80	1517.80	3586.34
INNUALS							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	.00	.00	.00	.00	.00	.00	.00
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	.00	.00	.00	.00	.00	.00	.00
ROOTS 6-20 CM	.00	.00	.00	.00	.00	.00	.00
ROOTS 20-70 CM	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	.00	.00	.00	.00	.00	.00
ALL SPECIES							
LEAVES	250.50	801.60	782.75	1913.09	1565.50	4261.34	10020.02
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	24762.80	99051.20	77383.60	56279.09	379883.60	513546.27	1213376.33
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	1814.14	7256.56	5669.19	4123.10	27830.54	37622.83	88892.94

'OOTS 6-20 CM	12094.60	48378.40	37795.62	27488.37	185543.70	250827.68	592640.16
'OOTS 20-70 CM	16322.80	65290.20	51007.99	37096.27	250402.09	338506.32	799802.80
TOTAL	55244.84	220777.95	172639.14	126899.92	845225.41	1144764.47	2704732.19

UND COVER BY DIFFERENT PLANT SPECIES, PER CENT.

LYCIUM ANDERSONII	5.364
KRAMERIA PARVIFOLIA	3.282
LARREA TRIDENTATA	3.510
EPHEDRA NEVADENSIS	1.371
AMBROSIA DUMOSA	1.873
GRAYIA SPINOSA	.653
LYCIUM PALLIDUM	.520
EUROTIA LANATA	.124
OTHER PERENNIALS	.164
ANNUALS	.000
TOTAL	15.768

PERENNIALS 15.768 ANNUALS .000

STITUENTS OF SHED SEEDS

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
IUM ANDERSONII	30.00	30.00	90.00	144.00	32.73	266.73	600.01
MERIA PARVIFOLIA	70.00	70.00	210.00	336.00	76.36	622.36	1399.99
REA TRIDENTATA	80.00	80.00	240.00	384.00	87.27	711.27	1599.99
EDRA NEVADENSIS	1000.00	1000.00	3000.00	4800.00	1090.91	8890.91	20000.00
ROSIA DUMOSA	10.00	10.00	30.00	48.00	10.91	88.91	200.00
YIA SPINOSA	10.00	10.00	30.00	48.00	10.91	88.91	200.00
IUM PALLIDUM	10.00	10.00	30.00	48.00	10.91	88.91	200.00
OTIA LANATA	10.00	10.00	30.00	48.00	10.91	88.91	200.00
ER PERENNIALS	10.00	10.00	30.00	48.00	10.91	88.91	200.00
UALS	10.00	10.00	30.00	48.00	10.91	88.91	200.00
TOTAL	1240.00	1240.00	3720.00	5952.00	1352.73	11024.73	24800.01

STITUENTS OF ANIMAL BIOMASS, G. OR KCAL.PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
IPODOMYS MERRIAMI							
ADULT	.83	1.44	1.90	6.09	1.51	9.50	15.46
JUVENILE	.00	.00	.00	.00	.00	.00	.00
TOTAL	.83	1.44	1.90	6.09	1.51	9.50	15.46
AL, ALL SPECIES	.83	1.44	1.90	6.09	1.51	9.50	15.46

MAL POPULATIONS, PER HECTARE

IPODOMYS MERRIAMI	
ADULT	.92
JUVENILE	.00
TOTAL	.92

STITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE

TYPE OF MATERIAL	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
3. STANDING DEAD	40.00	800.00	125.00	90.91	3977.27	4193.18	10000.00
DY STANDING DEAD	28.46	56.92	87.64	63.74	27.89	179.27	434.20
3. LITTER	8.00	160.00	25.00	18.18	795.45	838.63	1999.99
DY LITTER	140.00	2800.00	437.50	318.18	13920.45	14676.13	34999.99
T ANIM. PARTS	240.00	480.00	1200.00	1200.00	9600.00	12000.00	19939.20
LETONS	24.00	48.00	120.00	120.00	960.00	1200.00	1993.92

XCRETA, SURFACE	240.00	480.00	1200.00	1200.00	9600.00	12000.00	19939.20
EAD ROOTS 0-6CM	205.60	4112.00	642.50	467.27	20443.18	21552.95	51399.99
EAD ROOTS 6-20CM	1370.80	27416.00	4283.75	3115.45	136301.13	143700.33	342699.97
EAD ROOTS 20-70CM	1850.00	37000.00	5781.25	4204.55	183948.86	193934.66	462500.00
TOTAL	4146.36	73352.92	13902.64	10798.28	379574.27	404275.14	945906.44

OIL VARIABLES

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	ORG.D.M.
RGANIC MATTER CONSTITUENTS							
FROM 0. TO 60. MM.	130400.00	652000.00	326000.00	326000.00	2608000.00	3260000.00	8606400.00
FROM 60. TO 200. MM.	134400.00	672000.00	336000.00	336000.00	2688000.00	3360000.00	8870400.00
FROM 200. TO 700. MM.	428000.00	2140000.00	1070000.00	1070000.00	8560000.00	10700000.00	28248000.00
TOTAL	692800.00	3464000.00	1732000.00	1732000.00	13856000.00	17320000.00	45724800.00
N MINERAL FRACTION							
FROM 0. TO 60. MM.	180000.00	77000.00					
FROM 60. TO 200. MM.	74000.00	171000.00					
FROM 200. TO 700. MM.	188000.00	505000.00					
TOTAL	442000.00	753000.00					
OTAL, SOIL AND DEAD ORGANIC MATERIAL	1138946.86	4290352.87	1745902.62	1742798.27	14235574.12	17724275.00	46670706.00
OTAL IN ECOSYSTEM	1195432.52	4512372.25	1922263.66	1875656.27	15082153.75	18880073.50	49400253.50

OIL WATER POTENTIAL, ATM.

FROM 0. TO 60. MM.	-20.00
FROM 60. TO 200. MM.	-20.00
FROM 200. TO 700. MM.	-20.00

PORT NO. 1 ON APR 10 1971 (I.E., AFTER 121 DAYS OF SIMULATION)

NSTITUENTS OF VEGETATIONAL BIOMASS, G. OR KCAL. PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
CIUM ANDERSONII							
LEAVES	1107.90	3545.03	3185.76	8749.23	6931.57	18866.56	44502.75
YOUNG STEMS	35.61	142.56	102.31	90.27	547.75	739.83	1752.59
OLDER STEMS AND BASES	10067.63	40278.01	31396.47	22837.76	154589.78	208824.01	493432.30
INFLORESCENCES	9.57	34.83	27.50	38.13	119.33	184.96	437.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	741.12	2965.03	2310.51	1681.96	11380.01	15372.48	36324.14
ROOTS 6-20 CM	4929.97	19723.57	15371.96	11185.95	75700.44	102258.34	241628.48
ROOTS 20-70 CM	6655.03	26625.10	20751.15	15099.68	102188.99	138039.81	326177.11
TOTAL	23546.82	93314.12	73145.65	59682.96	351457.37	484285.98	1144254.34
AMERIA PARVIFOLIA							
LEAVES	47.19	150.97	147.44	360.30	294.88	802.62	1887.27
YOUNG STEMS	.00	.00	.00	.00	.00	.00	.00
OLDER STEMS AND BASES	5682.27	22746.09	17614.28	12810.39	87497.12	117921.79	278696.87
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	415.83	1664.56	1289.01	937.46	6403.04	8629.52	20395.03
ROOTS 6-20 CM	2774.82	11107.58	8601.57	6255.69	42727.41	57584.67	136095.86
ROOTS 20-70 CM	3748.37	15004.70	11619.45	8450.51	57718.41	77788.37	183845.37
TOTAL	12668.48	50673.91	39271.76	28814.34	194640.86	262726.96	620920.39
RREA TRIDENTATA							
LEAVES	379.10	1213.06	1110.75	2972.23	2371.31	6454.29	15214.01
YOUNG STEMS	1.63	6.51	4.67	4.12	24.99	33.78	80.02
OLDER STEMS AND BASES	5007.32	20029.28	15647.45	11380.69	76816.86	103845.01	245358.94
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	365.56	1462.24	1142.29	830.91	5608.04	7581.29	17912.53
ROOTS 6-20 CM	2440.19	9760.75	7625.25	5546.23	37434.71	50606.18	119569.41
ROOTS 20-70 CM	3292.72	13170.90	10289.35	7483.89	50513.41	68286.64	161343.76
TOTAL	11486.51	45642.73	35819.77	28218.06	172769.31	236807.14	559478.66
HEDRA NEVADENSIS							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	90.29	361.44	259.40	228.86	1387.48	1875.74	4443.46
OLDER STEMS AND BASES	1816.24	7265.17	5658.68	4145.56	27864.55	37668.79	89010.24
INFLORESCENCES	24.26	88.30	69.71	96.67	302.56	468.93	1107.98
SEEDS	421.48	421.58	1161.51	2129.65	460.31	3751.47	8492.32
ROOTS 0-6 CM	137.16	548.67	426.35	314.09	2104.39	2844.83	6722.74
ROOTS 6-20 CM	894.31	3577.36	2785.62	2041.99	13720.49	18548.11	43828.98
ROOTS 20-70 CM	1196.72	4787.03	3728.38	2731.66	18360.01	24820.04	58649.10
TOTAL	4580.47	17049.55	14089.65	11688.48	64199.78	89977.91	212254.80
BROSIA DUMOSA							
LEAVES	100.38	321.19	289.83	791.45	627.99	1709.27	4031.25
YOUNG STEMS	2.11	8.44	6.05	5.34	32.38	43.78	103.71
OLDER STEMS AND BASES	1257.36	5031.82	3909.39	2843.38	19334.26	26087.02	61647.76
INFLORESCENCES	.45	1.65	1.30	1.80	5.65	8.76	20.69
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	92.29	369.33	286.92	208.74	1419.13	1914.79	4524.96
ROOTS 6-20 CM	614.16	2457.78	1909.42	1388.97	9443.76	12742.15	30111.77
ROOTS 20-70 CM	828.75	3316.54	2576.60	1874.26	12743.46	17194.32	40632.95
TOTAL	2895.50	11506.74	8979.51	7113.96	43606.62	59700.09	141073.09
AYIA SPINOSA							

LEAVES	69.85	223.60	201.16	551.15	437.46	1189.77	2806.34
YOUNG STEMS	11.51	46.09	33.06	29.17	176.95	239.17	566.59
OLDER STEMS AND BASES	401.92	1608.72	1245.22	910.21	6184.87	8340.29	19711.77
INFLORESCENCES	.74	2.69	2.14	2.94	9.23	14.31	33.79
SEEDS	1.25	1.25	3.47	6.30	1.37	11.13	25.19
ROOTS 0-6 CM	29.86	119.51	92.42	67.72	459.45	619.59	1464.40
ROOTS 6-20 CM	195.85	783.89	606.87	443.41	3013.76	4064.03	9605.03
ROOTS 20-70 CM	264.05	1056.89	818.31	597.70	4063.32	5479.34	12949.96
TOTAL	975.02	3842.64	3002.64	2608.59	14346.40	19957.63	47163.07
.YCIUM PALLIDUM							
LEAVES	47.62	152.38	136.97	376.06	297.95	810.98	1912.94
YOUNG STEMS	5.58	22.34	16.03	14.14	85.75	115.92	274.61
OLDER STEMS AND BASES	357.90	1431.96	1115.35	811.34	5497.34	7424.03	17542.75
INFLORESCENCES	.35	1.29	1.02	1.41	4.43	6.86	16.21
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	27.61	110.46	86.01	62.62	424.05	572.68	1353.24
ROOTS 6-20 CM	175.29	701.33	546.17	397.48	2692.44	3636.09	8592.01
ROOTS 20-70 CM	236.52	946.32	736.96	536.32	3632.95	4906.23	11593.32
TOTAL	850.87	3366.08	2638.50	2199.37	12634.92	17472.79	41285.07
URotia LANATA							
LEAVES	4.14	13.26	12.10	32.64	25.79	70.53	166.27
YOUNG STEMS	.11	.45	.33	.29	1.74	2.35	5.57
OLDER STEMS AND BASES	65.64	262.76	203.44	147.97	1010.81	1362.22	3219.51
INFLORESCENCES	.02	.07	.05	.08	.24	.37	.87
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	4.78	19.15	14.82	10.79	73.66	99.27	234.61
ROOTS 6-20 CM	32.06	128.32	99.34	72.27	493.64	665.25	1572.27
ROOTS 20-70 CM	43.20	172.94	133.88	97.40	665.27	896.56	2118.96
TOTAL	149.96	596.95	463.97	361.43	2271.15	3096.55	7318.05
THER PERENNIALS							
LEAVES	1.01	3.25	2.93	8.00	6.35	17.28	40.76
YOUNG STEMS	.02	.08	.06	.05	.32	.44	1.04
OLDER STEMS AND BASES	32.81	131.26	102.19	74.41	503.54	680.15	1607.25
INFLORESCENCES	.00	.00	.00	.00	.00	.00	.00
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	2.39	9.55	7.45	5.46	36.64	49.55	117.07
ROOTS 6-20 CM	15.91	63.66	49.62	36.72	245.87	332.21	784.64
ROOTS 20-70 CM	21.88	86.53	67.48	48.63	331.47	447.58	1058.00
TOTAL	74.02	294.34	229.73	173.28	1124.20	1527.21	3608.76
NNUALS							
LEAVES	34.70	113.13	98.54	268.65	230.39	597.57	1411.25
YOUNG STEMS	20.72	75.76	57.28	78.57	265.56	401.41	949.79
OLDER STEMS AND BASES	.00	.00	.00	.00	.00	.00	.00
INFLORESCENCES	17.13	62.35	49.87	67.60	213.61	331.07	781.91
SEEDS	22.84	22.85	63.91	114.43	24.94	203.29	459.70
ROOTS 0-6 CM	19.76	72.08	54.47	74.69	252.87	382.03	903.97
ROOTS 6-20 CM	11.22	41.68	31.37	43.09	145.73	220.19	521.00
ROOTS 20-70 CM	1.60	5.95	4.48	6.15	20.80	31.43	74.37
TOTAL	127.97	393.78	359.92	653.17	1153.90	2167.00	5101.98
LL SPECIES							
LEAVES	1791.90	5735.86	5185.47	14109.71	11223.70	30518.88	71972.84
YOUNG STEMS	167.58	663.66	479.18	450.80	2522.42	3452.41	8177.37
OLDER STEMS AND BASES	24689.09	98785.07	76892.47	55961.71	379299.12	121153.28	1210227.33
INFLORESCENCES	52.52	191.17	151.59	208.63	659.04	1015.26	2398.44
SEEDS	445.58	445.68	1228.90	2250.38	486.62	3965.90	8977.21
ROOTS 0-6 CM	1836.35	7340.58	5710.24	4194.44	28161.27	38065.95	89952.70

'OOTS 6-20 CM	12083.76	48745.92	37627.19	27411.79	185618.24	250657.20	592309.41
OOTS 20 70 CM	16288.84	65172.89	50726.05	36926.19	250238.08	337890.27	798442.87
TOTAL	57355.62	226680.83	178001.08	141513.65	858204.48	1177719.19	2782458.09

UND COVER BY DIFFERENT PLANT SPECIES, PER CENT.

LYCIUM ANDERSONII	5.805
KRAMERIA PARVIFOLIA	3.257
LARREA TRIDENTATA	3.567
EPHEDRA NEVADENSIS	1.489
AMBROSIA DUMOSA	1.979
GRAYIA SPINOSA	.773
LYCIUM PALLIDUM	.579
EUROTIA LANATA	.129
OTHER PERENNIALS	.167
ANNUALS	.947
TOTAL	17.328

PERENNIALS 16.537 ANNUALS .947

STITUENTS OF SHED SEEDS

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
IUM ANDERSONII	29.74	29.74	89.23	142.77	32.45	264.46	594.90
MERIA PARVIFOLIA	69.40	69.40	208.21	333.14	75.71	617.06	1388.07
REA TRIDENTATA	79.32	79.32	237.96	380.73	86.53	705.21	1586.37
EDRA NEVADENSIS	991.48	991.48	2974.45	4759.12	1081.62	8815.19	19829.67
ROSIA DUMOSA	9.91	9.91	29.74	47.59	10.82	88.15	198.30
YIA SPINOSA	9.91	9.91	29.74	47.59	10.82	88.15	198.30
IUM PALLIDUM	9.91	9.91	29.74	47.59	10.82	88.15	198.30
OTIA LANATA	9.91	9.91	29.74	47.59	10.82	88.15	198.30
ER PERENNIALS	9.91	9.91	29.74	47.59	10.82	88.15	198.30
UALS	8.43	8.43	25.28	40.45	9.19	74.93	168.55
TOTAL	1227.95	1227.95	3683.85	5894.17	1339.59	10917.61	24559.03

STITUENTS OF ANIMAL BIOMASS, G. OR KCAL.PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
IPODOMYS MERRIAMI							
ADULT	.64	1.07	1.49	5.68	1.13	8.30	13.16
JUVENILE	.37	.69	.80	5.96	.75	7.51	11.25
TOTAL	1.01	1.76	2.29	11.64	1.87	15.80	24.41
AL, ALL SPECIES	1.01	1.76	2.29	11.64	1.87	15.80	24.41

IAL POPULATIONS, PER HECTARE

IPODOMYS MERRIAMI	
ADULT	.72
JUVENILE	1.09
TOTAL	1.81

STITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE

TYPE OF MATERIAL	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
3. STANDING DEAD	17.60	357.32	55.83	40.60	1776.44	1872.88	4466.22
DY STANDING DEAD	144.43	532.95	455.54	331.31	1871.18	2658.04	6288.18
3. LITTER	181.02	1062.55	575.58	1251.72	3791.38	5618.68	13305.37
DY LITTER	143.49	2751.16	455.05	330.94	13621.75	14407.74	34355.05
T ANIM. PARTS	203.44	413.01	1032.15	1033.19	8253.94	10319.28	17146.42
LETONS	22.48	45.65	114.13	114.13	913.07	1141.34	1895.44

EXCRETA, SURFACE	183.26	362.71	889.28	889.63	7088.57	8867.48	14741.91
DEAD ROOTS 0-6CM	208.43	4026.79	652.00	474.18	19978.08	21104.25	50325.54
DEAD ROOTS 6-20CM	1416.22	27337.85	4427.40	3219.92	135629.17	143276.49	341660.10
DEAD ROOTS 20-70CM	1414.37	27595.95	4486.39	3262.83	136878.47	144627.70	344858.32
TOTAL	3934.74	64485.94	13143.34	10948.47	329802.05	353893.87	829043.55

SOIL VARIABLES

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	ORG.D.M.
ORGANIC MATTER CONSTITUENTS							
FROM 0. TO 60. MM.	130454.16	652204.73	326369.97	326396.25	2611603.84	3264370.06	8617214.00
FROM 60. TO 200. MM.	134389.51	672220.02	335992.34	335979.77	2689035.41	3361007.50	8873135.87
FROM 200. TO 700. MM.	425785.17	2138737.56	1065912.92	1065531.87	8559497.87	10690942.62	28225966.25
TOTAL	690628.84	3463162.31	1728275.22	1727907.87	13860137.12	17316320.00	45716316.00
IN MINERAL FRACTION							
FROM 0. TO 60. MM.	179770.57	76566.01					
FROM 60. TO 200. MM.	73384.44	168491.65					
FROM 200. TO 700. MM.	185923.31	511754.51					
TOTAL	439078.32	756812.16					
TOTAL, SOIL AND DEAD ORGANIC MATERIAL	1133641.87	4284460.37	1741418.56	1738856.33	14189939.12	17670213.75	46545359.50
TOTAL IN ECOSYSTEM	1192226.45	4512370.87	1923105.78	1886275.78	15049485.00	18858866.25	49352401.00

ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM

	WATER	MINERAL SOIL	NITROGEN	ASH ELEM.	TOTAL C
TO OR FROM ATMOSPHERE	-83250509.00	.00	-3206.26	.00	-21307.50
BY RUN-OFF OR RUN-ON	.00	.00	.00	.00	.00
TO OR FROM SUBSOIL	.00	.00	.00	.00	.00
TOTAL	-83250509.00	.00	-3206.26	.00	-21307.50

SOIL WATER POTENTIAL, ATM.

FROM 0. TO 60. MM.	-35.00
FROM 60. TO 200. MM.	-35.00
FROM 200. TO 700. MM.	-15.00

ACCUMULATED PRECIPITATION TO APR 10 1971 INCLUSIVE IS 9.4 MM. - THAT IS 94.0 TONS PER HECTARE

ROCK VALLEY -- ZONE 20

REPORT NO. 2 ON MAY 10 1971 (I.E., AFTER 151 DAYS OF SIMULATION)

CONSTITUENTS OF VEGETATIONAL BIOMASS, G. OR KCAL. PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
LYCIUM ANDERSONII							
LEAVES	1111.87	3557.62	3197.05	8780.32	6956.19	18933.57	44660.83
YOUNG STEMS	36.18	144.82	103.93	91.70	555.93	751.56	1780.39
OLDER STEMS AND BASES	10067.88	40279.02	31397.20	22838.40	154593.66	708829.26	493444.72
INFLORESCENCES	9.58	34.87	27.53	38.18	119.49	185.20	437.57
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	741.17	2965.25	2310.66	1682.10	11380.86	15373.62	36326.86
ROOTS 6-20 CM	4930.19	19724.45	15372.59	11186.50	75703.83	102262.92	241639.32
ROOTS 20-70 CM	6655.31	26626.20	20751.95	15100.37	102193.23	138045.54	326190.70
TOTAL	23552.14	93332.24	73160.91	59717.57	351503.18	484381.67	1144480.36
KRAMERIA PARVIFOLIA							
LEAVES	239.82	767.34	700.50	1882.48	1500.14	4083.12	9625.75
YOUNG STEMS	30.21	120.92	86.80	76.56	464.27	627.57	1486.65
OLDER STEMS AND BASES	5709.73	22856.02	17693.18	12879.99	87919.12	118492.29	280048.33
INFLORESCENCES	2.95	10.74	8.48	11.76	36.81	57.05	134.80
SEEDS	3.20	3.21	8.83	16.19	3.50	28.53	64.57
ROOTS 0-6 CM	421.32	1686.55	1304.79	951.38	6487.44	8743.67	20665.33
ROOTS 6-20 CM	2796.79	11195.53	8664.70	6311.37	43065.01	58041.08	137177.04
ROOTS 20-70 CM	3775.83	15114.63	11698.36	8520.11	58140.42	78358.88	185196.85
TOTAL	12979.84	51754.93	40165.64	30649.84	197616.65	268432.13	634399.31
LARREA TRIDENTATA							
LEAVES	1123.48	3594.97	3247.83	8854.84	7028.96	19131.63	45119.16
YOUNG STEMS	28.75	115.07	82.59	72.86	441.76	597.22	1414.75
OLDER STEMS AND BASES	5014.10	20056.42	15666.93	11397.88	76921.04	103985.85	245692.57
INFLORESCENCES	2.91	10.61	8.38	11.61	36.35	56.34	133.12
SEEDS	9.49	9.50	26.17	47.98	10.37	84.52	191.32
ROOTS 0-6 CM	368.27	1473.10	1150.09	837.78	5649.71	7637.58	18046.00
ROOTS 6-20 CM	2451.03	9804.17	7656.42	5573.72	37601.41	50831.55	120103.28
ROOTS 20-70 CM	3306.28	13225.18	10328.30	7518.26	50721.79	68568.35	162011.10
TOTAL	12304.32	48289.02	38166.70	34314.93	178411.39	250893.02	592711.29
EPHEDRA NEVADENSIS							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	118.92	480.96	338.55	298.80	1852.63	2489.97	5901.77
OLDER STEMS AND BASES	1841.59	7374.98	5725.18	4206.45	28296.77	38228.40	90341.95
INFLORESCENCES	26.56	96.68	76.37	105.84	331.28	513.45	1213.14
SEEDS	773.18	773.38	2131.96	3905.61	844.42	6881.99	15578.32
ROOTS 0-6 CM	142.14	569.26	440.18	326.47	2184.24	2950.90	6974.48
ROOTS 6-20 CM	913.72	3659.19	2838.25	2089.55	14039.93	18967.73	44826.04
ROOTS 20-70 CM	1220.87	4889.21	3793.56	2790.66	18759.30	25343.52	59893.16
TOTAL	5036.98	17843.66	15344.01	13723.38	66308.57	95375.95	224728.86
AMBROSIA DUMOSA							
LEAVES	283.25	906.51	814.77	2236.47	1772.97	4824.22	11379.35
YOUNG STEMS	11.45	45.84	32.89	29.01	175.99	237.89	563.54
OLDER STEMS AND BASES	1259.56	5040.65	3915.57	2848.87	19368.36	26132.79	61756.25
INFLORESCENCES	2.30	8.38	6.67	9.15	28.70	44.48	105.10
SEEDS	.27	.27	.76	1.31	.29	2.36	5.33
ROOTS 0-6 CM	93.06	372.42	289.12	210.69	1430.98	1930.78	4562.85
ROOTS 6-20 CM	617.23	2470.10	1918.18	1396.72	9491.15	12806.05	30263.18
ROOTS 20-70 CM	832.58	3331.93	2587.54	1883.94	12802.70	17274.18	40822.18
TOTAL	3099.69	12176.09	9565.46	8616.16	45071.13	63252.75	149457.78
GRAYIA SPINOSA							

LEAVES	73.11	234.03	210.52	576.92	457.86	1245.30	2937.32
YOUNG STEMS	11.63	46.56	33.40	29.47	178.78	241.64	572.43
OLDER STEMS AND BASES	401.98	1608.96	1245.39	910.36	6185.78	8341.53	19714.69
INFLORESCENCES	.52	1.89	1.50	2.06	6.46	10.01	23.66
SEEDS	.88	.88	2.43	4.41	.96	7.79	17.63
ROOTS 0-6 CM	29.87	119.55	92.45	67.75	459.63	619.83	1464.90
ROOTS 6-20 CM	195.89	784.08	607.00	443.53	3014.49	4065.02	9607.37
ROOTS 20-70 CM	264.11	1057.13	818.48	597.85	4064.23	5480.57	12952.88
TOTAL	977.98	3853.08	3011.17	2632.34	14368.18	20011.69	47290.97
YCIUM PALLIDUM							
LEAVES	103.58	331.44	297.61	818.28	648.09	1763.99	4161.04
YOUNG STEMS	28.52	114.15	81.93	72.28	438.22	592.43	1403.40
OLDER STEMS AND BASES	358.41	1434.00	1116.81	812.63	5505.18	7434.62	17567.83
INFLORESCENCES	.63	2.29	1.81	2.51	7.84	12.15	28.72
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	27.81	111.27	86.59	63.14	427.19	576.92	1353.27
ROOTS 6-20 CM	176.10	704.60	548.51	399.55	2704.97	3653.03	8632.14
ROOTS 20-70 CM	237.54	950.40	739.89	538.90	3648.62	4927.41	11643.49
TOTAL	932.59	3648.15	2873.15	2707.29	13380.10	18960.54	44799.89
UROTIA LANATA							
LEAVES	4.26	13.64	12.43	33.54	26.59	72.56	171.07
YOUNG STEMS	.13	.52	.37	.33	2.01	2.72	6.43
OLDER STEMS AND BASES	65.65	262.82	203.43	147.97	1011.08	1362.49	3220.15
INFLORESCENCES	.03	.11	.09	.12	.37	.57	1.36
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	4.79	19.16	14.83	10.79	73.71	99.33	234.77
ROOTS 6-20 CM	32.07	128.37	99.35	72.28	493.86	665.49	1572.86
ROOTS 20-70 CM	43.21	173.00	133.89	97.42	665.54	896.86	2119.67
TOTAL	150.13	597.62	464.40	362.46	2273.17	3100.02	7326.31
THER PERENNIALS							
LEAVES	2.79	8.93	8.03	22.03	17.46	47.52	112.08
YOUNG STEMS	.11	.42	.30	.27	1.62	2.19	5.18
OLDER STEMS AND BASES	32.83	131.33	102.24	74.45	503.82	680.51	1608.11
INFLORESCENCES	.00	.01	.01	.01	.04	.06	.14
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	2.39	9.58	7.46	5.48	36.75	49.69	117.41
ROOTS 6-20 CM	15.94	63.77	49.70	36.79	246.29	332.78	785.97
ROOTS 20-70 CM	21.91	86.67	67.58	48.71	331.99	448.28	1059.67
TOTAL	75.97	300.71	235.31	187.74	1137.97	1561.02	3688.56
ANNUALS							
LEAVES	34.70	113.13	98.54	268.65	230.39	597.57	1411.25
YOUNG STEMS	20.72	75.76	57.28	78.57	265.56	401.41	949.79
OLDER STEMS AND BASES	.00	.00	.00	.00	.00	.00	.00
INFLORESCENCES	17.13	62.35	49.87	67.60	213.61	331.07	781.91
SEEDS	22.84	22.85	63.91	114.43	24.94	203.29	459.70
ROOTS 0-6 CM	19.76	72.08	54.47	74.69	252.87	382.03	903.97
ROOTS 6-20 CM	11.22	41.68	31.37	43.09	145.73	220.19	521.00
ROOTS 20-70 CM	1.60	5.95	4.48	6.15	20.80	31.43	74.37
TOTAL	127.97	393.78	359.92	653.17	1153.90	2167.00	5101.98
ALL SPECIES							
LEAVES	2976.81	9527.61	8587.28	23473.53	18638.66	50699.46	119577.86
YOUNG STEMS	286.60	1145.03	818.03	749.85	4376.71	5944.59	14084.35
OLDER STEMS AND BASES	24751.71	99044.19	77065.92	56116.99	380304.79	513487.68	1213394.56
INFLORESCENCES	62.62	227.92	180.61	248.84	780.95	1210.40	2859.50
SEEDS	809.87	810.07	2234.07	4089.93	884.48	7208.47	16316.87
ROOTS 0-6 CM	1850.59	7398.21	5750.65	4230.27	28383.38	38364.29	90659.92

ROOTS 6-20 CM	12140.18	48575.93	37786.07	27553.10	186506.65	251845.81	595128.16
ROOTS 20-70 CM	16359.24	65460.29	50924.03	37102.37	251348.60	339374.96	801954.03
TOTAL	59237.61	232189.26	183346.67	153564.87	871224.21	1208135.73	2853985.19

GROUND COVER BY DIFFERENT PLANT SPECIES, PER CENT.

LYCIUM ANDERSONII	5.833
KRAMERIA PARVIFOLIA	3.371
LARREA TRIDENTATA	3.978
EPHEDRA NEVADENSIS	1.534
AMBROSIA DUMOSA	2.220
GRAYIA SPINOSA	.783
LYCIUM PALLIDUM	.683
EUROTIA LANATA	.129
OTHER PERENNIALS	.175
ANNUALS	.994
TOTAL	18.179

PERENNIALS 17.358 ANNUALS .994

CONSTITUENTS OF SHED SEEDS

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
LYCIUM ANDERSONII	29.65	29.65	88.95	142.32	32.35	263.61	592.99
KRAMERIA PARVIFOLIA	69.18	69.18	207.54	332.07	75.47	615.08	1383.62
LARREA TRIDENTATA	79.06	79.06	237.19	379.51	86.25	702.95	1581.29
EPHEDRA NEVADENSIS	988.31	988.31	2964.93	4743.89	1078.16	8786.97	19766.19
AMBROSIA DUMOSA	9.88	9.88	29.65	47.44	10.78	87.87	197.66
GRAYIA SPINOSA	10.26	10.26	30.69	49.32	11.19	91.21	205.21
LYCIUM PALLIDUM	9.88	9.88	29.65	47.44	10.78	87.87	197.66
EUROTIA LANATA	9.88	9.88	29.65	47.44	10.78	87.87	197.66
OTHER PERENNIALS	9.88	9.88	29.65	47.44	10.78	87.87	197.66
ANNUALS	8.40	8.40	25.20	40.32	9.16	74.69	168.01
TOTAL	1224.39	1224.39	3673.10	5877.19	1335.71	10885.99	24487.97

CONSTITUENTS OF ANIMAL BIOMASS, G. OR KCAL.PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
DIPODOMYS MERRIAMI							
ADULT	.61	1.01	1.40	6.25	1.06	8.72	13.58
JUVENILE	.51	.97	1.11	6.30	1.05	8.46	13.04
TOTAL	1.12	1.98	2.51	12.55	2.12	17.17	26.63
TOTAL, ALL SPECIES	1.12	1.98	2.51	12.55	2.12	17.17	26.63

ANIMAL POPULATIONS, PER HECTARE

DIPODOMYS MERRIAMI	
ADULT	.68
JUVENILE	1.02
TOTAL	1.70

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE

TYPE OF MATERIAL	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
HERB. STANDING DEAD	16.23	331.47	51.79	37.67	1647.93	1737.39	4143.02
WOODY STANDING DEAD	142.71	529.76	452.82	329.33	1859.99	2642.13	6249.70
HERB. LITTER	180.33	1082.69	576.79	1248.02	3899.20	5724.01	13555.91
WOODY LITTER	143.20	2748.84	456.86	332.26	13605.69	14394.81	34323.05
SOFT ANIM. PARTS	199.87	408.18	1019.95	1021.55	8155.31	10196.81	16942.80
SKELETONS	22.26	45.47	113.68	113.68	909.42	1136.77	1888.86

EXCRETA, SURFACE	180.38	355.40	864.52	864.98	6881.04	8610.54	14317.86
DEAD ROOTS 0-6CM	207.52	4010.70	649.39	472.78	19898.25	21019.92	50124.36
DEAD ROOTS 6-20CM	1416.22	27337.85	4427.40	3219.92	135629.17	143276.49	341660.10
DEAD ROOTS 20-70CM	1410.98	27540.79	4477.42	3256.31	136604.86	144338.59	344168.39
TOTAL	3919.69	64391.16	13090.60	10896.00	329090.86	353077.45	827374.05

SOIL VARIABLES

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	ORG.D.M.
ORGANIC MATTER CONSTITUENTS							
FROM 0. TO 60. MM.	130448.75	652183.66	326379.03	326408.11	2611742.34	3264529.47	8617577.00
FROM 60. TO 200. MM.	134389.51	672220.02	335992.34	335979.77	2689035.41	3361007.50	8873135.87
FROM 200. TO 700. MM.	425736.91	2138578.91	1065814.42	1065431.22	8558888.25	10690133.87	28223835.75
TOTAL	690575.17	3462982.56	1728185.78	1727819.08	13859666.00	17315670.75	45714548.50
IN MINERAL FRACTION							
FROM 0. TO 60. MM.	179486.97	76259.19					
FROM 60. TO 200. MM.	72692.12	166348.09					
FROM 200. TO 700. MM.	184779.87	508974.34					
TOTAL	436958.96	751581.62					
TOTAL, SOIL AND DEAD ORGANIC MATERIAL	1131453.81	4278955.31	1741276.37	1738715.06	14188756.75	17668748.00	46541922.50
TOTAL IN ECOSYSTEM	1191916.94	4512370.94	1928298.64	1898169.66	15061318.75	18887786.75	49420422.00

ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM

	WATER	MINERAL SOIL	NITROGEN	ASH ELEM.	TOTAL C
TO OR FROM ATMOSPHERE	60007359.00	.00	-3515.81	.00	7195.15
BY RUN-OFF OR RUN-ON	.00	.00	.00	.00	.00
TO OR FROM SUBSOIL	.00	.00	.00	.00	.00
TOTAL	60007359.00	.00	-3515.81	.00	7195.15

SOIL WATER POTENTIAL, ATM.	
FROM 0. TO 60. MM.	-1.30
FROM 60. TO 200. MM.	-22.00
FROM 200. TO 700. MM.	-22.00

ACCUMULATED PRECIPITATION TO MAY 10 1971 INCLUSIVE IS 26.7 MM. - THAT IS 267.0 TONS PER HECTARE 1.016 SF

ROCK VALLEY -- ZONE 20

REPORT NO. 3 ON JUNE 25 1971 (I.E., AFTER 197 DAYS OF SIMULATION)

CONSTITUENTS OF VEGETATIONAL BIOMASS, G. OR KCAL. PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
LYCIUM ANDERSONII							
LEAVES	699.64	2238.69	2011.79	5525.16	4377.29	11914.24	28103.53
YOUNG STEMS	36.33	145.44	104.38	92.09	558.30	754.76	1787.97
OLDER STEMS AND BASES	10067.96	40279.33	31397.42	22838.60	154594.84	208830.35	493448.50
INFLORESCENCES	6.03	21.93	17.32	24.01	75.16	116.49	275.23
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	741.19	2965.32	2310.71	1682.14	11381.10	15373.94	36327.61
ROOTS 6-20 CM	4930.25	19724.70	15372.77	11186.66	75704.77	102264.20	241642.34
ROOTS 20-70 CM	6655.38	26626.51	20752.17	15100.57	102194.41	138047.14	326194.48
TOTAL	23136.78	92001.91	71966.55	56449.22	348885.86	477301.62	1127779.64
KRAMERIA PARVIFOLIA							
LEAVES	2516.61	8057.71	7235.59	19874.08	15770.46	42880.14	101148.11
YOUNG STEMS	388.27	1554.90	1114.58	983.54	5971.73	8069.84	19117.24
OLDER STEMS AND BASES	6033.89	24155.94	18620.30	13699.22	92917.18	125236.70	296028.01
INFLORESCENCES	22.67	82.52	65.65	89.85	282.78	438.28	1035.27
SEEDS	81.17	81.19	224.74	409.17	88.66	722.57	1635.16
ROOTS 0-6 CM	486.28	1946.76	1491.11	1115.88	7487.06	10094.05	23864.57
ROOTS 6-20 CM	3056.43	12236.03	9408.58	6968.35	47063.47	63440.40	149968.89
ROOTS 20-70 CM	4100.34	16415.17	12627.87	9341.08	63138.49	85107.44	201185.38
TOTAL	16685.67	64530.23	50788.42	52481.17	232719.82	335989.41	793982.62
LARREA TRIDENTATA							
LEAVES	1393.32	4472.21	4025.20	10995.29	8757.81	23778.30	56084.68
YOUNG STEMS	67.53	270.68	193.76	170.99	1039.66	1404.40	3327.13
OLDER STEMS AND BASES	5030.54	20125.72	15711.29	11438.01	77191.94	104341.24	246537.10
INFLORESCENCES	3.96	14.41	11.44	15.72	49.39	76.55	180.84
SEEDS	91.46	91.48	254.19	459.97	99.88	814.04	1841.65
ROOTS 0-6 CM	372.11	1488.73	1160.91	847.41	5710.10	7718.41	18237.68
ROOTS 6-20 CM	2466.17	9866.47	7698.49	5611.33	37842.94	51152.77	120865.50
ROOTS 20-70 CM	3325.14	13302.98	10380.59	7565.05	51023.71	68969.35	162962.78
TOTAL	12750.22	49632.68	39435.87	37103.76	181715.42	258255.06	610037.36
EPHEDRA NEVADENSIS							
LEAVES	.00	.00	.00	.00	.00	.00	.00
YOUNG STEMS	122.94	498.15	349.40	308.42	1920.00	2577.82	6110.61
OLDER STEMS AND BASES	1845.41	7391.97	5734.88	4215.48	28364.14	38314.51	90547.16
INFLORESCENCES	26.56	96.68	76.33	105.84	331.28	513.45	1213.14
SEEDS	836.19	836.40	2305.67	4223.90	913.23	7442.81	16847.81
ROOTS 0-6 CM	142.98	572.72	442.47	328.54	2197.72	2968.73	7016.82
ROOTS 6-20 CM	916.95	3672.95	2846.89	2097.42	14093.82	19038.13	44993.41
ROOTS 20-70 CM	1224.88	4906.39	3804.23	2800.40	18826.67	25431.30	60101.92
TOTAL	5115.91	17975.26	15559.88	14080.00	66646.87	[illegible]6286.74	226830.87
AMBROSIA DUMOSA							
LEAVES	169.10	541.31	486.40	1335.16	1058.96	2880.52	6799.63
YOUNG STEMS	12.63	50.57	36.27	32.00	194.15	262.42	621.65
OLDER STEMS AND BASES	1260.12	5042.96	3917.07	2850.22	19377.44	[illegible]6144.73	61784.62
INFLORESCENCES	1.41	5.14	4.08	5.61	17.61	27.29	64.47
SEEDS	.31	.31	.91	1.55	.34	2.80	6.32
ROOTS 0-6 CM	93.18	372.89	289.44	210.97	1432.79	1933.21	4568.61
ROOTS 6-20 CM	617.69	2471.96	1919.45	1397.85	9498.41	12815.71	30286.10
ROOTS 20-70 CM	833.15	3334.27	2589.11	1885.34	12811.78	17285.27	40850.79
TOTAL	2987.60	11819.41	9242.71	7718.71	44391.50	61352.91	144977.19
GRAYIA SPINOSA							

LEAVES	43.46	139.13	125.15	342.98	272.20	740.33	1746.25
YOUNG STEMS	11.65	46.64	33.46	29.52	179.09	242.06	573.43
OLDER STEMS AND BASES	401.99	1609.00	1245.42	910.38	6185.93	8341.74	19715.19
INFLORESCENCES	.28	1.03	.82	1.13	3.54	5.49	12.96
SEEDS	.48	.48	1.33	2.41	.52	4.27	9.66
ROOTS 0-6 CM	29.87	119.56	92.46	67.76	459.66	619.88	1465.09
ROOTS 6-20 CM	195.90	784.17	607.02	443.55	3014.61	4065.18	9607.77
ROOTS 20-70 CM	264.12	1057.17	818.51	597.88	4064.39	5480.78	17953.38
TOTAL	947.75	3757.13	2924.18	2395.61	14179.95	19499.73	46083.72
.YCIUM PALLIDUM							
LEAVES	65.15	208.48	187.20	514.70	407.65	1109.55	2617.29
YOUNG STEMS	28.52	114.15	81.93	72.28	438.22	592.43	1403.40
OLDER STEMS AND BASES	358.41	1434.00	1116.81	812.63	5505.18	7434.62	17567.83
INFLORESCENCES	.40	1.44	1.14	1.58	4.93	7.64	18.06
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	27.81	111.27	86.59	63.14	427.19	576.92	1363.27
ROOTS 6-20 CM	176.10	704.60	548.51	399.55	2704.97	3653.03	8632.14
ROOTS 20-70 CM	237.54	950.40	739.89	538.90	3648.62	4927.41	11643.49
TOTAL	893.93	3524.34	2762.06	2402.77	13136.75	18301.59	43245.49
EUROTIA LANATA							
LEAVES	2.69	8.62	7.85	21.20	16.81	45.86	108.12
YOUNG STEMS	.13	.54	.38	.34	2.06	2.78	6.58
OLDER STEMS AND BASES	65.65	262.83	203.43	147.97	1011.13	1362.53	3220.26
INFLORESCENCES	.02	.07	.06	.08	.25	.38	.90
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	4.79	19.16	14.83	10.79	73.72	99.34	234.80
ROOTS 6-20 CM	32.07	128.38	99.35	72.29	493.89	665.53	1572.96
ROOTS 20-70 CM	43.22	173.01	133.90	97.42	665.59	896.91	2119.79
TOTAL	148.57	592.61	459.80	350.08	2263.45	3073.33	7263.41
OTHER PERENNIALS							
LEAVES	2.07	6.63	5.96	16.36	12.98	35.29	83.25
YOUNG STEMS	.11	.44	.31	.28	1.68	2.27	5.37
OLDER STEMS AND BASES	32.83	131.34	102.24	74.46	503.85	680.54	1608.19
INFLORESCENCES	.00	.01	.01	.01	.04	.06	.14
SEEDS	.00	.00	.00	.00	.00	.00	.00
ROOTS 0-6 CM	2.39	9.58	7.47	5.48	36.75	49.70	117.42
ROOTS 6-20 CM	15.94	63.77	49.70	36.79	246.31	332.80	786.04
ROOTS 20-70 CM	21.91	86.68	67.58	48.72	332.02	448.32	1059.75
TOTAL	75.26	298.45	233.26	182.09	1133.63	1548.98	3660.16
ANNUALS							
LEAVES	20.47	66.74	58.14	158.50	135.93	352.57	832.64
YOUNG STEMS	12.23	44.70	33.79	46.36	156.68	236.83	560.38
OLDER STEMS AND BASES	.00	.00	.00	.00	.00	.00	.00
INFLORESCENCES	10.11	36.78	29.42	39.88	126.03	195.33	461.33
SEEDS	13.48	13.48	37.71	67.52	14.72	119.94	271.22
ROOTS 0-6 CM	18.95	69.12	52.24	71.62	242.50	366.36	866.91
ROOTS 6-20 CM	10.76	39.97	30.09	41.32	139.76	211.16	499.64
ROOTS 20-70 CM	1.54	5.70	4.29	5.90	19.95	30.14	71.32
TOTAL	87.52	276.50	245.68	431.10	835.56	1512.35	3563.43
ALL SPECIES							
LEAVES	4912.52	15739.52	14143.29	38783.43	30810.09	83736.80	197518.50
YOUNG STEMS	680.33	2726.20	1948.25	1735.79	10461.56	14145.60	33513.76
OLDER STEMS AND BASES	25096.79	100433.08	78048.85	56986.96	385651.62	520687.41	1230456.81
INFLORESCENCES	71.44	260.03	206.25	283.71	891.00	1380.96	3262.34
SEEDS	1023.09	1023.35	2824.55	5164.52	1117.36	9106.43	20611.83
ROOTS 0-6 CM	1919.55	7675.12	5948.23	4403.72	29448.59	39800.54	94062.78

ROOTS 6-20 CM	12418.26	49692.94	78580.85	78255.10	190802.96	257638.89	608854.76
ROOTS 20-70 CM	16707.22	66858.27	51918.14	77981.26	256725.61	346624.98	819143.05
TOTAL	62829.20	244408.51	193618.42	173594.50	905908.77	1273121.66	3007423.81

GROUND COVER BY DIFFERENT PLANT SPECIES, PER CENT.

LYCIUM ANDERSONII	5.663
KRAMERIA PARVIFOLIA	4.794
LARREA TRIDENTATA	4.184
EPHEDRA NEVADENSIS	1.542
AMBROSIA DUMOSA	2.090
GRAYIA SPINOSA	.744
LYCIUM PALLIDUM	.679
EUROTIA LANATA	.127
OTHER PERENNIALS	.172
ANNUALS	.598
TOTAL	18.916

PERENNIALS 18.479 ANNUALS .598

CONSTITUENTS OF SHED SEEDS

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
LYCIUM ANDERSONII	29.50	29.50	88.51	141.62	32.19	262.32	590.08
KRAMERIA PARVIFOLIA	69.66	69.66	208.80	334.58	75.99	619.37	1393.35
LARREA TRIDENTATA	79.60	79.60	238.60	382.30	86.84	707.73	1592.13
EPHEDRA NEVADENSIS	983.46	983.46	2950.38	4720.61	1072.87	8743.87	19669.22
AMBROSIA DUMOSA	10.05	10.05	30.13	48.28	10.97	89.38	201.08
GRAYIA SPINOSA	10.60	10.60	31.63	51.07	11.57	94.27	212.15
LYCIUM PALLIDUM	9.83	9.83	29.50	47.21	10.73	87.44	196.69
EUROTIA LANATA	9.83	9.83	29.50	47.21	10.73	87.44	196.69
OTHER PERENNIALS	9.83	9.83	29.50	47.21	10.73	87.44	196.69
ANNUALS	17.70	17.71	51.23	86.94	19.32	157.49	355.26
TOTAL	1230.09	1230.09	3687.79	5907.02	1341.93	10936.74	24603.36

CONSTITUENTS OF ANIMAL BIOMASS, G. OR KCAL.PER HECTARE

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
DIPODOMYS MERRIAMI							
ADULT	.55	.92	1.28	6.64	.97	8.89	13.62
JUVENILE	.72	1.37	1.54	5.81	1.49	8.84	14.32
TOTAL	1.27	2.29	2.82	12.45	2.46	17.73	27.94
TOTAL, ALL SPECIES	1.27	2.29	2.82	12.45	2.46	17.73	27.94

ANIMAL POPULATIONS, PER HECTARE

DIPODOMYS MERRIAMI	
ADULT	.62
JUVENILE	.93
TOTAL	1.55

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE

TYPE OF MATERIAL	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	DRY MATTER
HERB. STANDING DEAD	21.74	354.68	73.87	68.70	1718.25	1860.82	4431.81
WOODY STANDING DEAD	123.15	524.91	448.67	326.31	1842.95	2617.94	6174.21
HERB. LITTER	746.70	3092.33	2377.55	6145.37	7893.64	16416.56	38719.13
WOODY LITTER	124.86	2731.78	457.36	332.62	13514.25	14304.23	34088.12
SOFT ANIM. PARTS	171.40	401.90	1003.98	1006.48	8025.94	10036.40	16676.12
SKELETONS	19.31	45.29	113.22	113.22	905.79	1132.24	1881.32

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	ORG.D.M.
EXCRETA, SURFACE	156.28	346.94	833.24	833.86	6616.14	8283.25	13778.49
DEAD ROOTS 0-6CM	201.78	3981.68	646.45	471.58	19749.98	20868.01	49756.92
DEAD ROOTS 6-20CM	1411.02	27312.21	4424.26	3218.47	135499.47	143142.19	341335.43
DEAD ROOTS 20-70CM	1411.04	27541.03	4477.61	3256.56	136605.66	144339.82	344171.32
TOTAL	4387.27	66332.74	14856.20	15773.18	372372.06	363001.44	851012.86

SOIL VARIABLES

	NITROGEN	ASH ELEM.	PROTEIN C	RESERVE C	OTHER C	TOTAL C	ORG.D.M.
ORGANIC MATTER CONSTITUENTS							
FROM 0. TO 60. MM.	130422.98	652171.42	326388.82	326425.81	2611984.41	3264799.03	8618203.12
FROM 60. TO 200. MM.	134385.55	672233.91	335989.60	335975.95	2689103.69	3361069.22	8873307.87
FROM 200. TO 700. MM.	425776.91	2138578.91	1065814.42	1065431.22	8558888.25	10690133.87	28223835.75
TOTAL	690545.44	3462984.22	1728192.84	1727832.97	13859976.25	17316002.00	45715341.50
IN MINERAL FRACTION							
FROM 0. TO 60. MM.	177619.82	75284.80					
FROM 60. TO 200. MM.	71179.98	160902.67					
FROM 200. TO 700. MM.	182438.06	501225.81					
TOTAL	431237.87	737413.27					
TOTAL, SOIL AND DEAD ORGANIC MATERIAL	1126170.56	4266730.19	1743049.03	1743606.14	14192348.25	17679003.25	46566354.00
TOTAL IN ECOSYSTEM	1190231.11	4512371.06	1940358.05	1923120.09	15099601.37	18963079.25	49598409.00

ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM

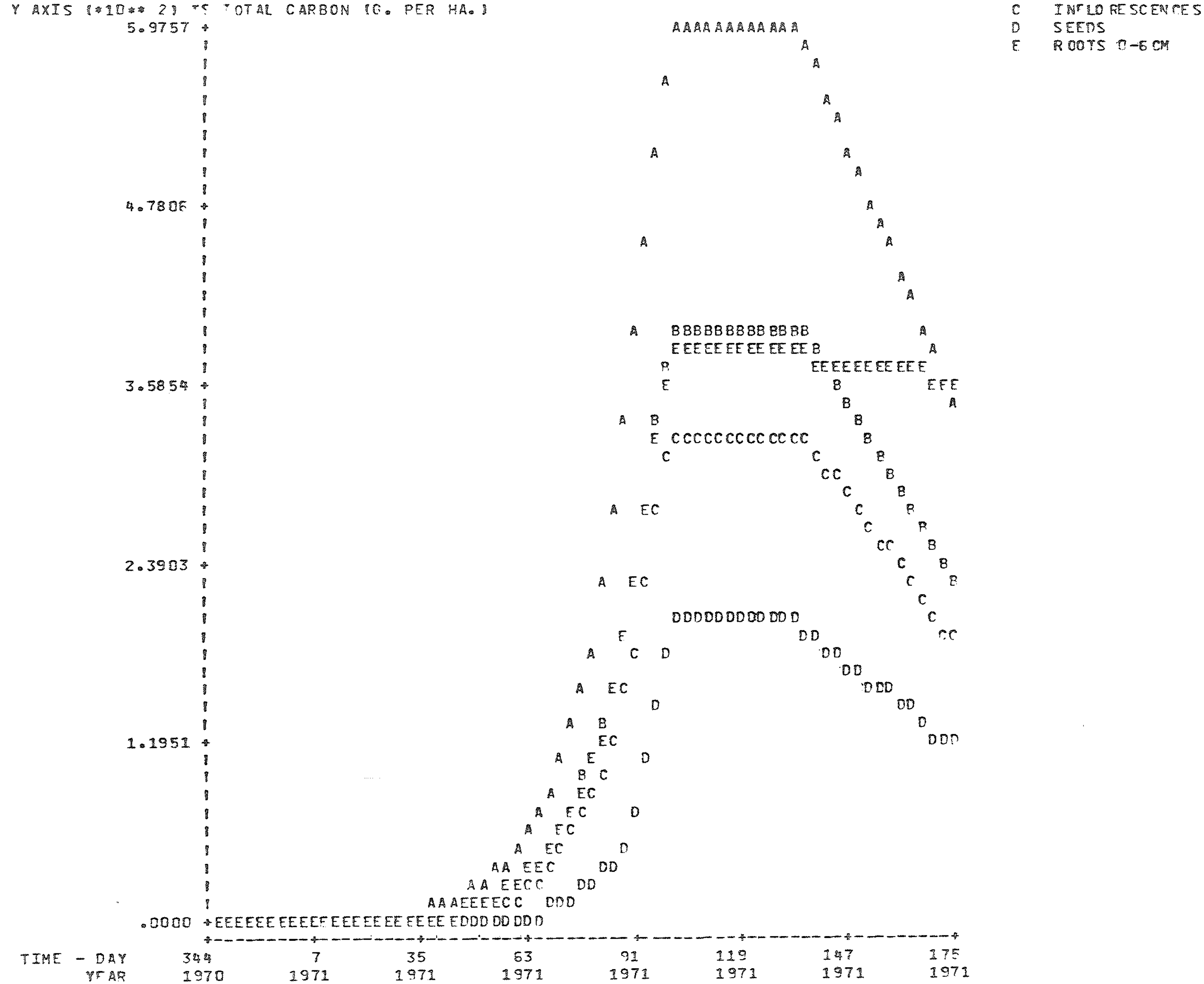
	WATER	MINERAL SOIL	NITROGEN	ASH ELEM.	TOTAL C
TO OR FROM ATMOSPHERE	-133312962.00	.00	-5201.73	.00	82619.23
BY RUN-OFF OR RUN-ON	.00	.00	.00	.00	.00
TO OR FROM SUBSOIL	.00	.00	.00	.00	.00
TOTAL	-133312962.00	.00	-5201.73	.00	82619.23

SOIL WATER POTENTIAL, ATM.

FROM 0. TO 60. MM.	-35.00
FROM 60. TO 200. MM.	-35.00
FROM 200. TO 700. MM.	-22.00

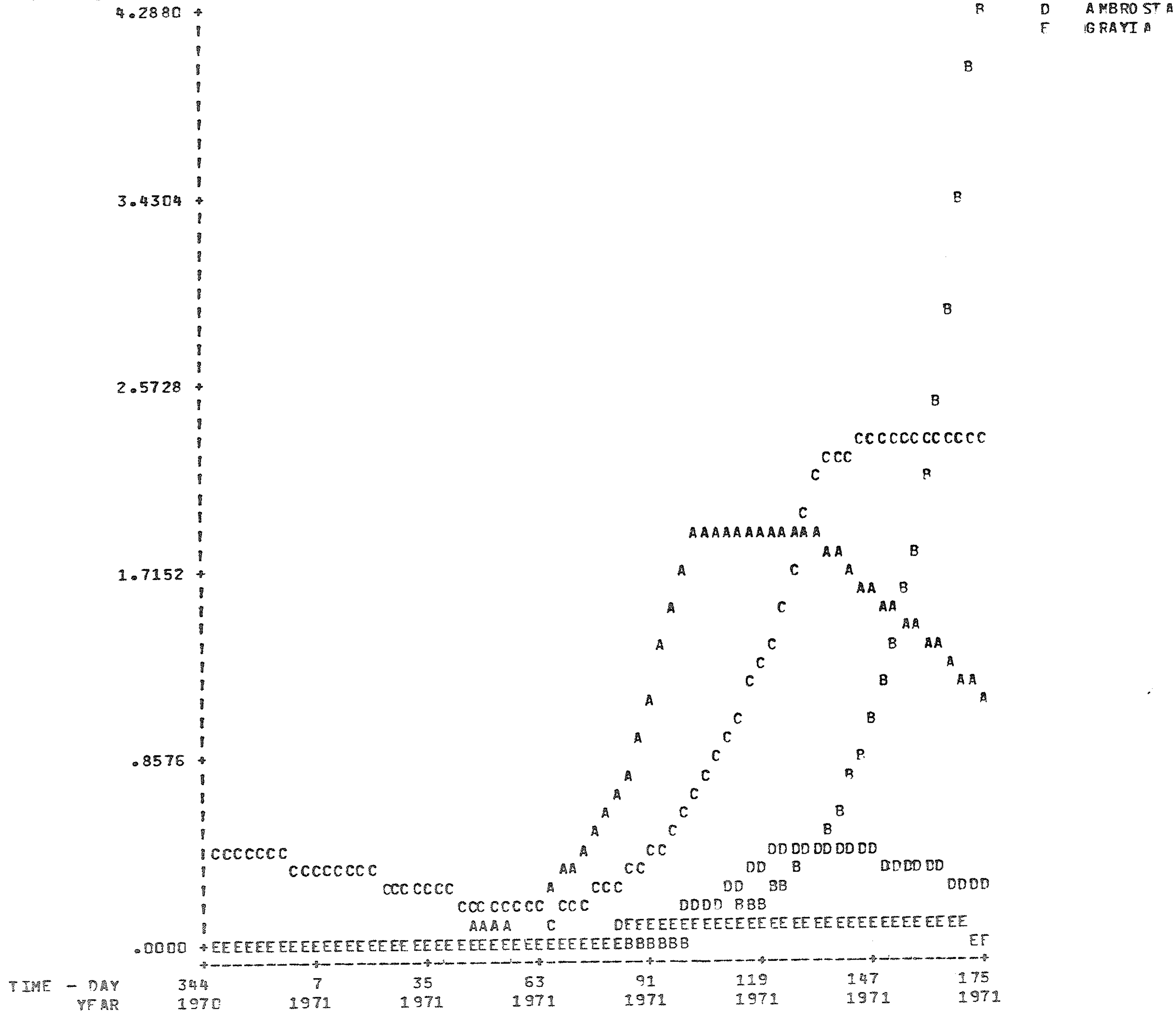
ACCUMULATED PRECIPITATION TO JUNE 25 1971 INCLUSIVE IS 28.7 MM. - THAT IS 287.0 TONS PER HECTARE

BIOMASS OF ANNUALS, BY ORGAN

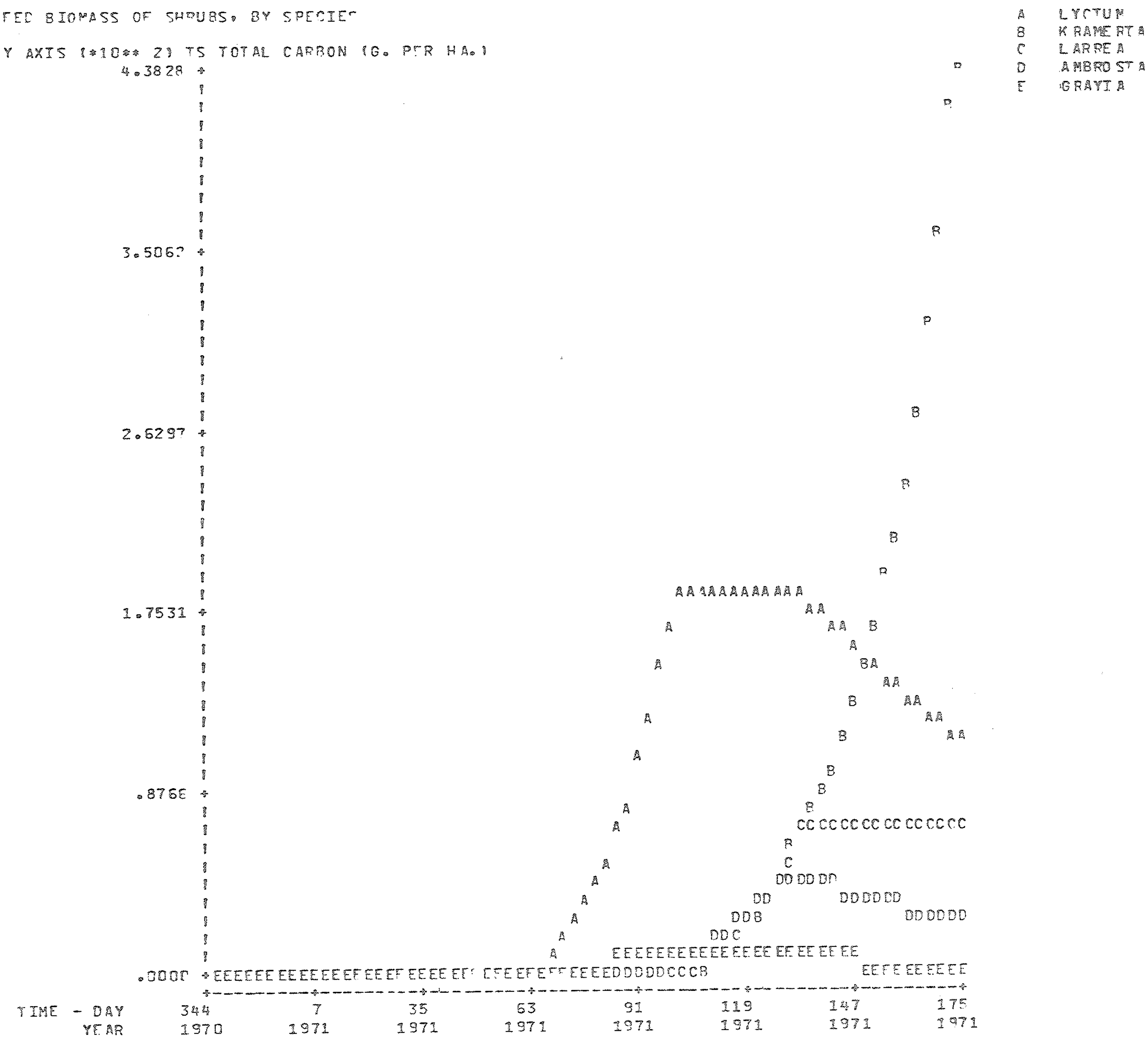


LEAF BIOMASS OF SHRUBS, BY SPECIES

Y AXIS (*10** 4) IS TOTAL CARBON (G. PER HA.)

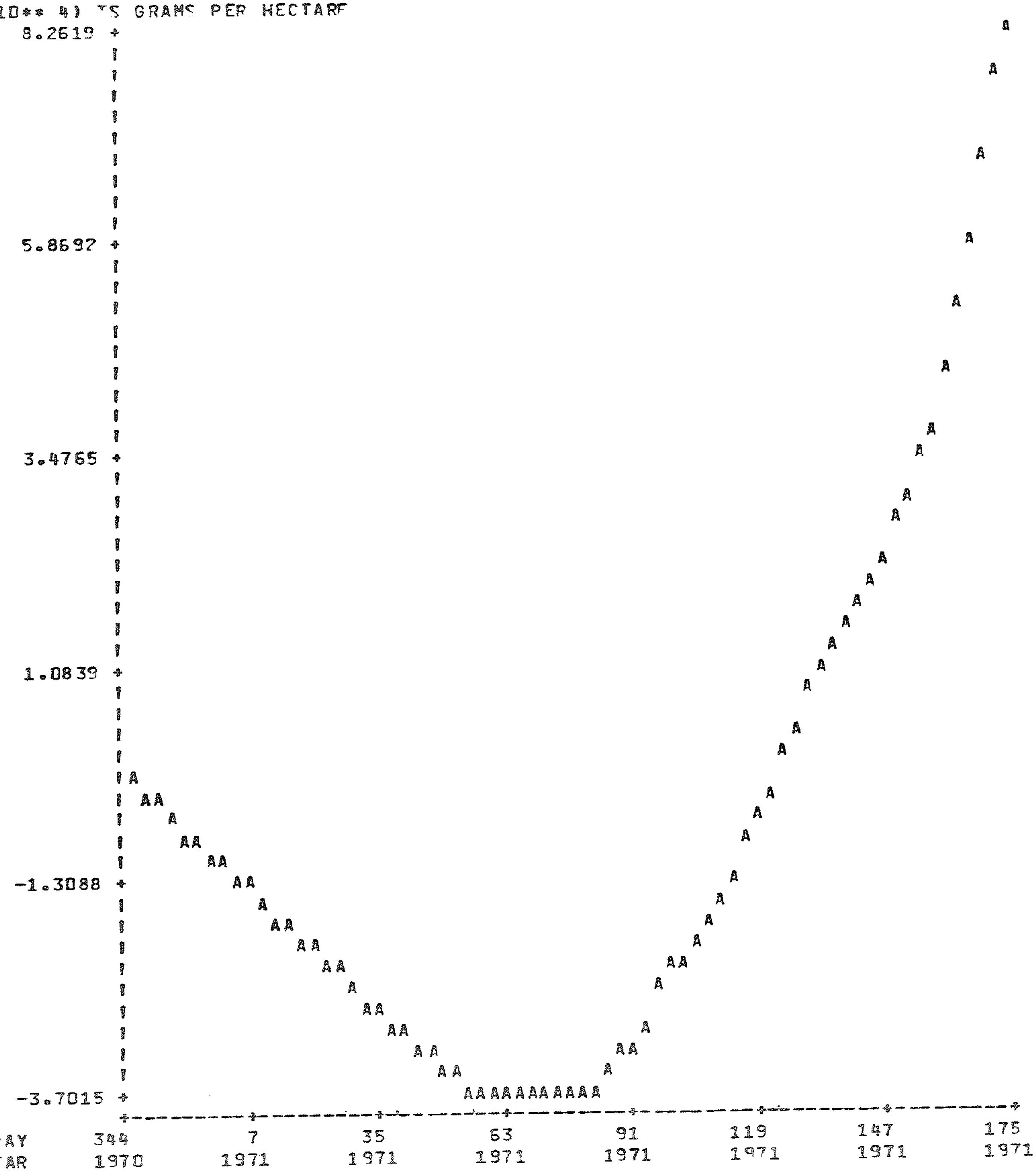


SEED BIOMASS OF SHRUBS, BY SPECIES



EXCHANGE OF CARBON WITH ATMOSPHERE(+ INPUT FROM, - OUTPUT TO)

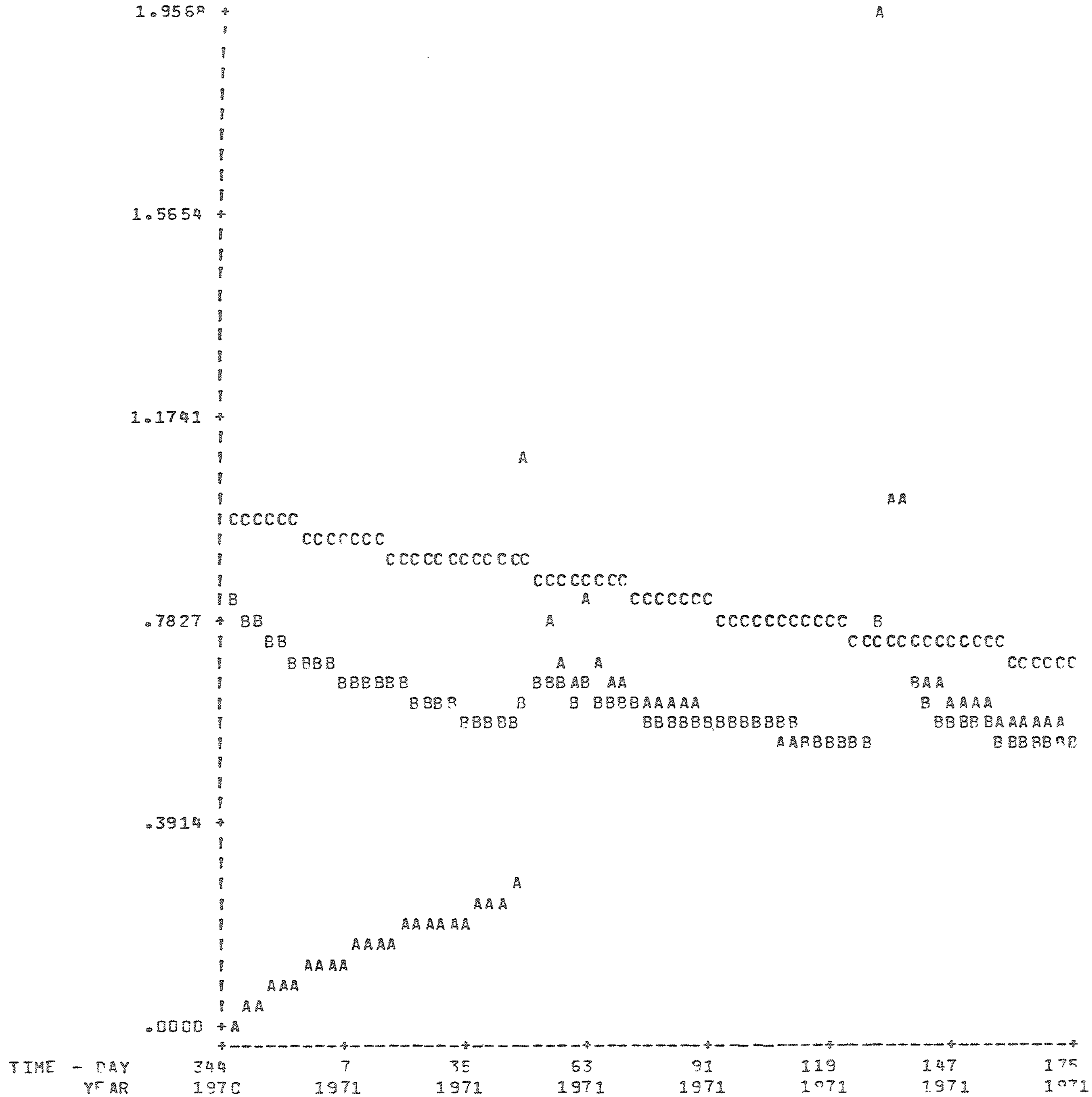
Y AXIS (*10** 4) IS GRAMS PER HECTARE



PERCENTAGE SATURATION OF SOIL(V/V BASIS)

A 0-6 CM
B 6-20 CM
C 20-70 CM

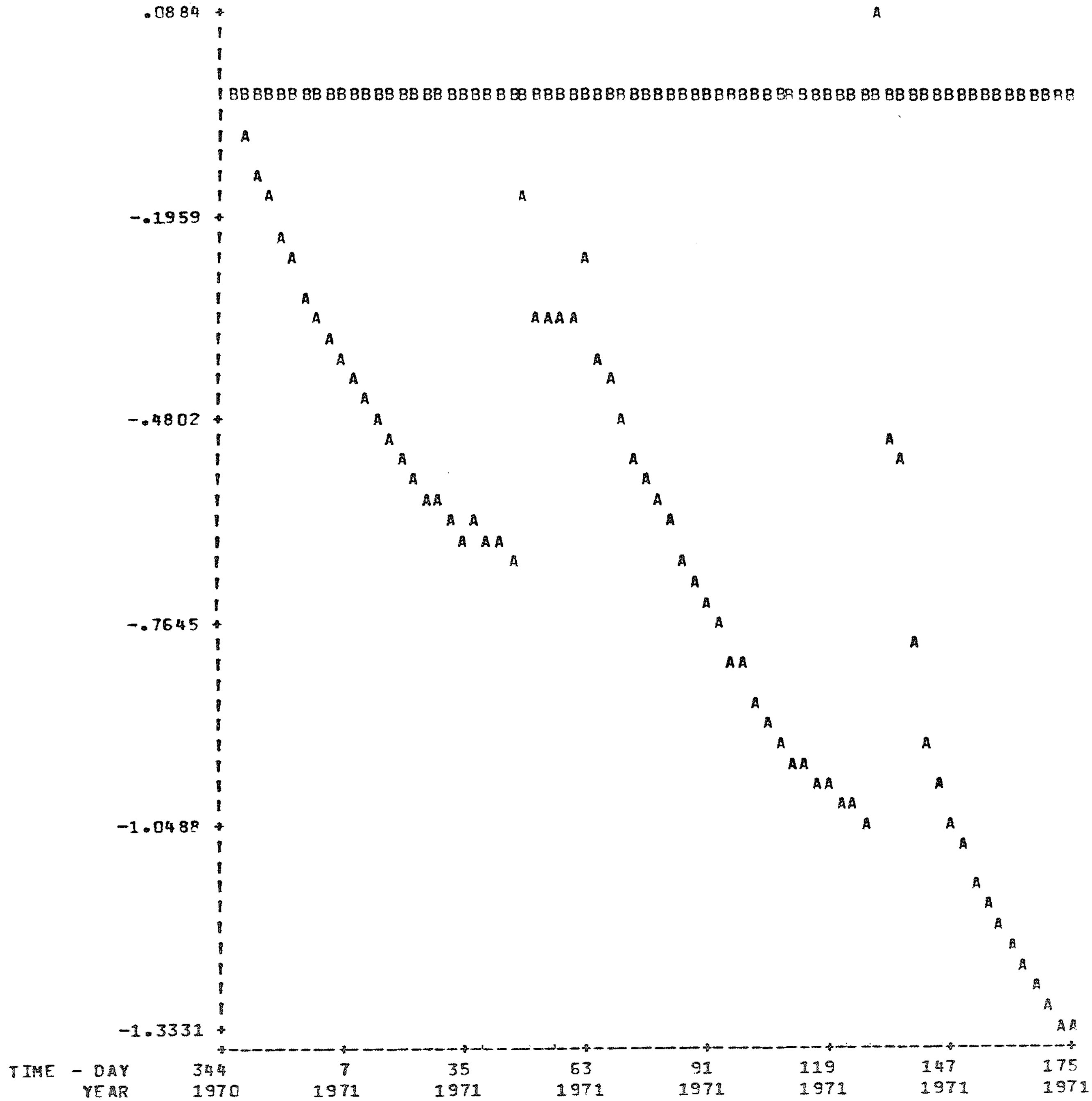
Y AXIS (*10**-1) IS FRACTION OF HORIZON WIDTH

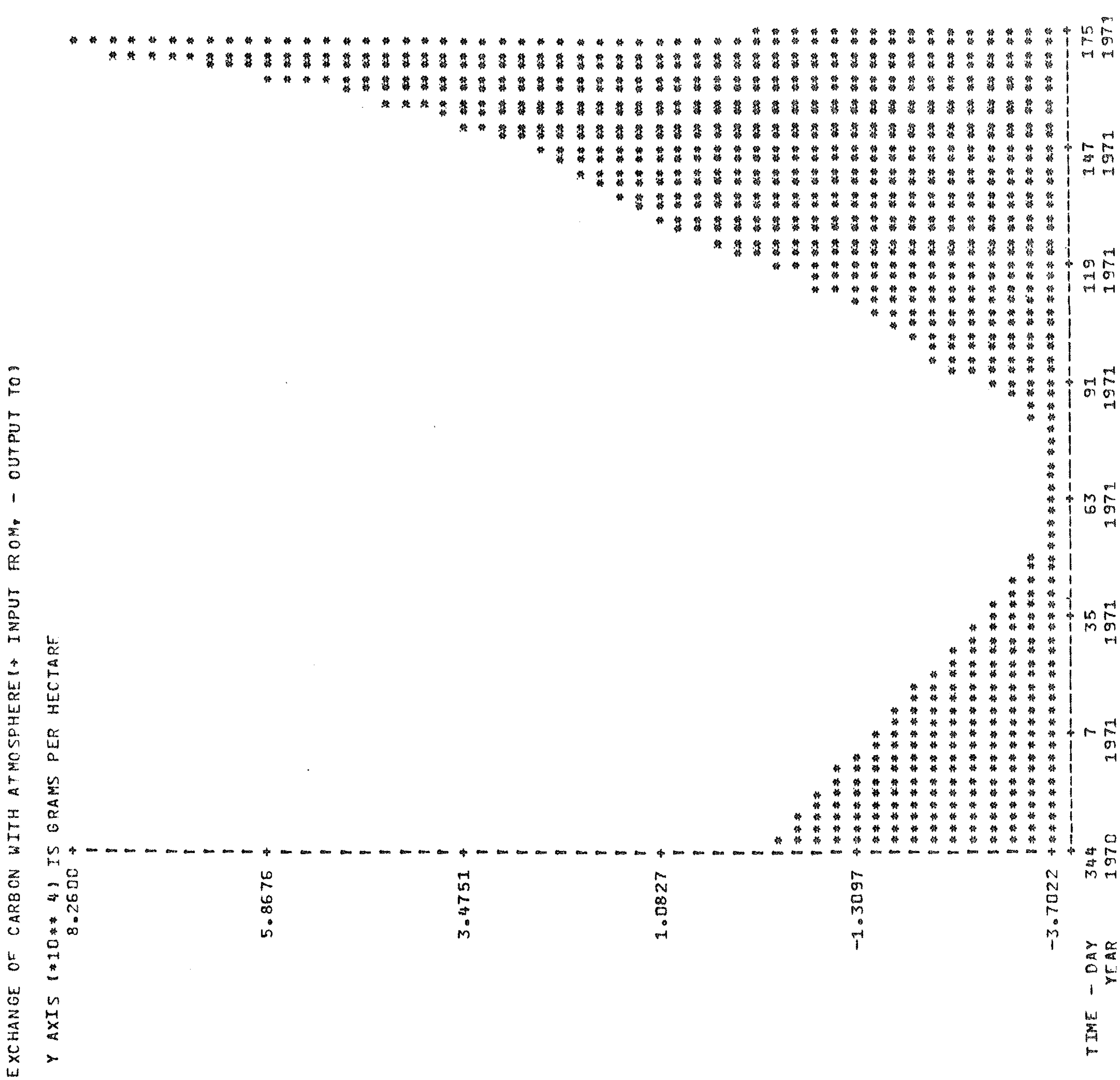


WATER EXCHANGE WITH ATMOSPHERE AND SURFACE LOSS

Y AXIS (*10** 8) TS GRAMS WATER PER HECTARE

A ATMOSPHERE
B SURFACE




EXCHANGE OF CARBON WITH ATMOSPHERE(+ INPUT FROM, - OUTPUT TO)
Y AXIS (*10** 4) IS GRAMS PER HECTARE
8.2600
5.8676
3.4751
1.0827
-1.3097
-3.7022
TIME - DAY
YEAR
344 1970
7 1971
35 1971
63 1971
91 1971
119 1971
147 1971
175 1971