1974

Terrestrial Model: Soil Processes (Version IV)

Paul Lommen

1973 PROGRESS REPORT

TERRESTRIAL MODEL: SOIL PROCESSES (VERSION IV)

Paul Lommen
Utah State University

US/IBP DESERT BIOME
RESEARCH MEMORANDUM 74-51

in

REPORTS OF 1973 PROGRESS
Volume 1: Central Office, Modelling
General-Purpose Model Section, pp. 51-72

NOVEMBER, 1974

Citation format: Author(s). 1974. Title.
US/IBP Desert Biome Res. Memo. 74-51.
Utah State Univ., Logan. 22 pp.

Ecology Center, Utah State University, Logan, Utah 84322

INTRODUCTION

This SOILS IV submodel is one of three sections that together comprise the ecosystem submodel. [A "submodel" constitutes a "model" in itself, and is sometimes referred to as a model without the formal designation of *sub*model.] SOILS IV is basically an interfacing of four main subdivisions: (1) SOILS III (Radford, 1973, with modifications); (2) the model for estimating water, salt and temperature distribution by Griffin, Hanks and Childs; (3) the nitrogen submodel of Parnas and Radford; (4) the decomposition submodel of Parnas and Radford.

Brief descriptions of the processes modeled in SOILS IV will be given here. For further information please consult one or more of the four separate reports cited above. The SOILS III subdivision can be divided into six components. These minor units are: (1) freezing of soil; (2) interception of rain by vegetation; (3) snow calculations; (4) artificial input/output; (5) wind and water erosion; (6) fungal-algal crust growth.

DESCRIPTION OF MAJOR SUBDIVISIONS

NITROGEN SUBMODEL

This model describes nitrogen transformations in the soil horizons by determining the growth and death rates of the microorganisms responsible for the transformations. The processes included are: (1) symbiotic fixation of nitrogen; (2) heterotrophic fixation of nitrogen; (3) autotrophic fixation of nitrogen; (4) NH_4^+ oxidation to NO_2^-; (5) NO_2^- oxidation to NO_3^-; (6) denitrification; (7) NH_3 volatilization.

As an example, consider the heterotrophic fixation of nitrogen. First, G, the maximum growth rate for these fixers for the present environmental conditions is calculated:

$$G = (GM) \cdot F_T \cdot F_{PH} \cdot F_S \cdot F_W \qquad (1)$$

where GM is the maximum growth rate under optimum conditions, and the F values are simple trapezoidal functions varying between 0 and 1 of temperature, pH, salinity, and soil water potential, respectively. The actual growth rate GR can then be calculated:

$$GR = \frac{G \times S}{S + K} \qquad (2)$$

where G is as in (1), S is substrate concentration (total soil organic carbon for heterotrophs) and K is the Michaelis-Menton constant for the reaction. The death rate D for these fixers has one of two values: (1) a high value if $S=0$; (2) a low value if $S>0$. The new value of biomass of heterotrophic fixers, BM, is:

$$(BM \text{ at } t + \Delta t) = (BM \text{ at } t) \times \exp(GR-D) \qquad (3)$$

where Δt is the time interval for which the change in biomass is calculated.

Only through death of the microorganisms do the minerals in the microbial biomass become available for enrichment of the soil.

DECOMPOSITION SUBMODEL

The main approach here follows the same idea as in the nitrogen model; namely, the rate of decomposition of a substance is proportional to the rate of growth of its decomposers. Growth rates are calculated in a manner identical to that used in the nitrogen submodel. Decomposition is calculated by "environmental zones," i.e., soil horizons, soil surface (litter and animal residues) and above the surface (standing dead).

MODEL FOR ESTIMATING WATER, SALT AND TEMPERATURE DISTRIBUTION IN THE SOIL PROFILE

The theoretical aspects of the model can be described by the following relationships. The soil water model involves the numeric solution to the one-dimensional general flow equation with a plant root extraction term, A(z) as given by Nimah and Hanks (1973):

$$\frac{\partial \theta}{\partial t} = \frac{\partial}{\partial z}\left[K(\theta)\frac{\partial H}{\partial z}\right] + A(z) \qquad (4)$$

A(z) is defined as:

$$A(z) = \frac{[Hroot + (RRES^*z) - h(z) - S(z)] * RDF(z) * K(\theta)}{\Delta z} \qquad (5)$$

Where θ is the volumetric water content, t is time, z is depth, K is hydraulic conductivity, H is hydraulic head, and Hroot is an effective water potential in the root at the soil surface where z is considered zero and RRES = 1 + Rc. Rc is a flow coefficient, h(z) is the soil pressure head at depth z, S(z) is the salt (osmotic) potential at depth z (in equivalent head units), and RDF(z) is the fraction of total active roots in depth increment Δz.

The partial differential equation describing soil temperature, T, as a function of depth, z, and time, t, in one dimension as given by Hanks et al. (1971) is:

$$\frac{\partial T}{\partial t} = \frac{\partial}{\partial z}\left[\sigma \frac{\partial T}{\partial z}\right]$$

where σ is the thermal diffusivity (which in general may be a function of time and depth). The thermal diffusivity is equal to the ratio of thermal conductivity to heat capacity.

The equation for the one-dimensional transient salt conditions was derived by Bresler (1973):

$$\frac{\partial}{\partial t}[\theta c] = \frac{\partial}{\partial z}[D(V,\theta)\frac{\partial c}{\partial z}] - \frac{\partial (qc)}{\partial z}$$

where c is the concentration of the solute, z is the vertical space coordinate (considered to be positive downward), $D(V,\theta)$ is the combined diffusion-dispersion coefficient, q is the volumetric flux of solution and V is the average interstitial flow velocity.

This model assumes that the soil is not layered and that its properties do not change with time. In the salt portion it is assumed that the solutes modeled do not interact with the soil. A separate service subroutine calculates potential evaporation and transpiration by use of the Blaney-Criddle estimate. A 28-day validation run using 1971 field data from Curlew Valley, Utah, showed excellent agreement between measured and predicted soil parameters.

DESCRIPTION OF MINOR SUBDIVISIONS

More information on these subdivisions can be found in the Desert Biome Research Memorandum on Soils III (Radford, 1973).

FREEZING OF SOIL

The entire soil is considered frozen if average air temperature is less than a minimum and snow is absent, or if the soil is already frozen and snow depth is greater than a minimum, or if snow depth is less than the minimum and average temperature is less than a second minimum different from (usually less than) the one already mentioned.

INTERCEPTION OF RAIN

Below a minimum amount of rainfall (depending on average vegetation height) all rainfall on vegetation is intercepted. Above this minimum a constant fraction is intercepted.

SNOW CALCULATIONS

Snow melting is proportional to the temperature difference between average daily temperature and a seasonally determined minimum. It is also proportional to the quantity of liquid water in contact with unmelted snow. If snow melting is impossible, snow blowing can occur. The amount lost from a snowfall at the time of fall is a seasonal fraction of the snow falling.

ARTIFICIAL INPUT/OUPUT

If this is desired, provisions have been made so that the water contents of a given horizon can be changed (positively or negatively) by a constant amount.

WIND AND WATER EROSION

Both erosional processes are handled similarly. For water erosion, the amount eroded is assumed to increase exponentially with runoff. Wind erosion increases exponentially with wind speed. Erosion also depends on wind gusts, average vegetation height, type of soil, amount of ground cover, and whether or not the soil is frozen.

FUNGAL-ALGAL CRUST GROWTH

A simple crust growth calculation is done here. If soil is not too dry or too wet crust grows at a rate proportional to total live-crust carbon times a seasonally determined proportionality constant.

INPUT/OUTPUT EXAMPLE AND PROGRAM LISTINGS

INPUT/OUTPUT EXAMPLE

Appendix 1 provides a listing of the input data deck and the resultant output for a hypothetical site.

PROGRAM LISTINGS

Appendix 2 lists the major programs as follows: DECOMP, NITRO, SOWAT, SOILS, followed by five service subroutines; DEGREE, EVAPO, OPT, RAMP, and DECLIN.

The main modification I have made is to change from NAMELIST to formatted input. This allows the entire program to be run on the Burroughs 6700 computer at Utah State University. It also allows comments to be placed in the data deck. These comments are useful in assembling the deck and for debugging purposes.

LITERATURE CITED

Bresler, E. 1973. Simultaneous transport of solute and water under transient unsaturated flow conditions. Water Resources Res. 9(4):975-986.

Griffin, R. A., R. J. Hanks, and S. Childs. 1974. Model for estimating water, salt and temperature distribution in the soil profile. US/IBP Desert Biome Res. Memo. 74-61. 12 pp.

Hanks, R. J., D. D. Austin, and W. T. Ondrechen. 1971. Soil Model -- heat, water and salt flow. US/IBP Desert Biome Res. Memo. 71-18. 12 pp.

Nimah, M. N., and R. J. Hanks. 1973. Model for estimating soil water, plant, and atmospheric interrelations: I. Description and sensitivity. Soil Sci. Soc. Am. Proc. 37(4): 522-527.

Parnas, H., and J. Radford. 1974. A decomposition submodel. US/IBP Desert Biome Res. Memo. 74-63. 23 pp.

Parnas, H., and J. Radford. 1974. A nitrogen submodel. US/IBP Desert Biome Res. Memo. 74-62. 12 pp.

Radford, J. 1973. Terrestrial models: Soil processes. (Versions I, II, III). US/IBP Desert Biome Res. Memo. 73-56. 196 pp.

APPENDIX 1

Input/Output Example

Data Listing

```
     INPUT - OUTPUT EXAMPLE    SOILS 4     DULUTH SITE
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975      PAUL W. LOHMEN
SOILS 4 IS BASICALLY RADFORD'S SOILS3 + HANK'S SOWAT + PARNAS' NITRO & DECOMP.

     INPUT - OUTPUT EXAMPLE      SOILS 4
   0    0    0    3    2   13    0    0    4    0    3    0    0    0
  91 1955  191    5    3    0
 106  121  136  151  166  181  196  211  226  241
  91   96    1    0    0
NITROGEN     SALTS        PROTEIN C   RESERVE C   STRUCTURAL C
DEAD ROOTS                GRASS DEAD              BROADLEAF HERB. DEAD
BROADLEAF WOODY DEAD      EPHEDRA STANDING DEAD   HERBACEOUS SURFACE LITTER
WOODY SURFACE LITTER      DEAD ROOTS 0-15CM       DEAD ROOTS 15-45CM
DEAD ROOTS 45-100 CM      DEAD ROOTS 100-200 CM   DUMMY MICROBES(N)
DUMMY MICROBES(D)
   1    1    1    1    1    1    1    1    1    1    1    1    1
     1.00       1.00        1.68        2.20        2.20
     1.00       1.00        1.50        2.50        2.50
     1.00       1.00        1.50        2.50        2.50
   2    5    6    7    8   11
   150.00     450.00    1000.00     2000.00
   10000.    10000.    10000.    10000.     100000.       DEAD ROOTS
   10000.    10000.    10000.    10000.     100000.        GRASS
   10000.    10000.    10000.    10000.     100000.       BROAD HERBY
   10000.    10000.    10000.    10000.     100000.       BROAD IN WOODS
   10000.    10000.    10000.    10000.     100000.      PHAEDRA
   10000.    10000.    10000.    10000.     100000.      SURFACE MONOTONY HERBY
   10000.    10000.    10000.    10000.     100000.      SURFACE MONOTONY WOODY
   10000.    10000.    10000.    10000.     100000.      DEAD DOOTS 1
   10000.    10000.    10000.    10000.     100000.      DEAD ROOTS 2
   10000.    10000.    10000.    10000.     100000.      DEAD ROOTS 3
   10000.    10000.    10000.    10000.     100000.       DEAD ROOTS 4
    1000.     1000.    10000.    10000.      10000.       DUMMY MICROBES(N)
 1100000.  1100000.  1100000.  1100000.    1100000.      DUMMY MICROBES(D)
   10000.    10000.    10000.    10000.     100000.      SOM 1
 10000.   10000.       20.
   10000.    10000.    10000.    10000.     100000.      SOM 2
 10000.   10000.       75.
   10000.    10000.    10000.    10000.     100000.      SOM 3
 10000.   10000.      120.
   10000.    10000.    10000.    10000.     100000.      SOM 4
 10000.   10000.      200.

0170601696
NITRATE AND AMONIUM IN TOP 15 CM OF SOIL
GRAMS N PER HECTARE
NITRATE
AMONIUM
1041810420
TOTAL CARBON IN HERBACEOUS STANDING DEAD AND HERBACEOUS LITTER
GRAMS PER HECTARE
HERB. STANDING
HERB. LITTER
3001130013
SOIL WATER POTENTIAL
ATMOSPHERES
150 - 450 MM
1000 - 2000 MM
DATA - - SOILS 4     I/O EXAMPLE    4-75    PAUL LOHMEN
SCALARS
    AHFAC,BHFAC,EMNUT,EMORG,FRZWNS,FRZWS, FWMAX,FWMAXC,FWMAXE,H2WFAC
  1.25000    0.02       0.00000    0.00000 -10.00000 -10.00000   0.00000   0.20000
  5.00000    0.10000
    ICF,ICRS,IDAYBS,IDUM,IEN,IFF,INAM,IS,ISALT,ISF,ITUWF,IVH,IX,JDUM,JSALT,JVH
    KA,KG,KS,L1,MTU,NDEP,NDIVLS,NLDIVS,NS,NSTORM,NTUWF,NVC,NVNODS,NVR
   0    1    0    0    1    0    1    2    2    0    0    4    1    0    2    4
   1    3    2    2   24    0    1    3    5    3   40    0    0    0
    POTDRY,POTWET,RUNFAC,SC2SO,SM2RN,SNOMIN,SNOMXE,SNOWAT,SWRFAC,V2APCT,WERFAC
  -200.00      1.00      0.00     10.00      0.20      5.00      3.00      2.00
    0.200     0.200
 5.000E+07
VECTORS
    AVINRT,BC,CFEPCT,COVFAC,CPRATE,CTRANS,DEPERO,DFAC
30.    25.     25.     25.     25.     25.     25.     25.     25.     25.
      0.00      0.00      0.00      0.00      0.00
      0.00      0.00      0.00      0.00      0.00      0.00
  0.0500 0.1000 0.1500 0.2000 0.2500 0.3000 0.3500 0.4000 0.4500 0.5000
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.38000   0.45000   0.38000   0.58000   0.47000
  2.00000   4.00000   6.00000   8.00000  10.00000  12.00000
  2.00000   2.00000   2.00000   2.00000   2.00000
    EFAC,EMDIRT,EMLIT,ERODED,GTU,HORWT,HRTFAC,HWIDTH,IAG,IEXDAY
  0.00000   .000000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.50000   0.50000   0.50000   0.50000   0.50000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 1.000E+08 2.000E+08 3.000E+08 4.000E+08 5.000E+08 6.000E+08
0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
 2.250E+09 4.500E+09 8.000E+09 1.600E+10 0.000E+00
  1.00000   1.00000   1.00000   1.00000   1.00000   1.00000   1.00000   1.00000
 150.      450.      1000.      2000.        0.
   1    2    3    3    3    3
   0    0    0    0    0
    ISEND,IVC,IVNODS,KSAT,L2L,NAMDAY,NGUST,SBFAC,SFLOW,SMFAC
  74  151  212  283  319    0    0    0
   1    2    3    4    5    0    0    0    0    0
   0    0    0    0    0
 25.00000  25.00000  25.00000  25.00000  25.00000
   0    7    7    8    7    8    0    0    0    0    0    0    0    0    0
   0    0    0    0    0
   0    0    0    0    0    0    0    0
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.10000   0.10000   0.10000   0.10000   0.10000   0.10000   0.10000   0.10000
    SMTEMP,STORM,TFAC,VCOVER,VHT,WATER,WATGC
  0.90000   0.90000   0.90000   0.90000   0.90000   0.90000   0.90000   0.90000
 5.0       10.0      15.0      20.0      20.0      15.0      10.0      5.0
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.38000   0.45000   0.38000   0.58000   0.40000   0.00000   0.00000
 50.0000 50.0000 10.0000 25.0000 15.0000  0.0000  0.0000  0.0000  0.0000  0.0000
 -10.00000 -10.00000 -10.00000 -10.00000 -10.00000
 75.00000 193.00000 273.00000 400.00000   0.00000
ARRAYS
    DNITL(15,8)
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
```

```
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
  0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100   0.00100
   L2LDIV(3,5)
  9   10   11
  9   10   11
  9   10   11
  9   10   11
  9   10   11
   ROF(8,5)
  0.25000   0.25000   0.25000   0.25000   0.25000   0.25000   0.25000   0.25000
  0.60000   0.60000   0.60000   0.60000   0.60      0.60000   0.60      0.60000
  0.15000   0.15000   0.15000   0.15000   0.15000   0.15000   0.15000   0.15000
  0.10000   0.10000   0.10000   0.10000   0.10000   0.10000   0.10000   0.10000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
   RTLDIV(8,3,5)
  0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500
  0.06      0.06      0.06      0.06      0.06      0.06      0.06      0.06
  0.015     0.015     0.015     0.015     0.015     0.015     0.015     0.015
  0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500
  0.06      0.06      0.06      0.06      0.06      0.06      0.06      0.06
  0.015     0.015     0.015     0.015     0.015     0.015     0.015     0.015
  0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500
  0.06      0.06      0.06      0.06      0.06      0.06      0.06      0.06
  0.015     0.015     0.015     0.015     0.015     0.015     0.015     0.015
  0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500
  0.06      0.06      0.06      0.06      0.06      0.06      0.06      0.06
  0.015     0.015     0.015     0.015     0.015     0.015     0.015     0.015
  0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500   0.02500
  0.06      0.06      0.06      0.06      0.06      0.06      0.06      0.06
  0.015     0.015     0.015     0.015     0.015     0.015     0.015     0.015
   RTL2L(15,8)
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00100   0.00100   0.00100   0.00500   0.00500   0.00000   0.00000   0.00000
  0.00300   0.00300   0.00300   0.00300   0.00300   0.00000   0.00000   0.00000
  0.00300   0.00300   0.01000   0.01000   0.00300   0.00000   0.00000   0.00000
  0.00300   0.00300   0.00300   0.00300   0.00300   0.00000   0.00000   0.00000
  0.00300   0.00300   0.01000   0.01000   0.00300   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
END READING IN SOILS DATA
DATA FOR NITRO,DECOMP - P,S,SMIN,MDUM,NZONES - READ FROM SOILS
       4.1       4.1       4.1       4.1       4.1       4.1       4.1       4.1
       4.3       4.3       4.3       4.3       4.3       4.3       4.3       4.3
       4.5       4.5       4.5       4.5       4.5       4.5       4.5       4.5
       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1
       5.3       5.3       5.3       5.3       5.3       5.3       5.3       5.3
       5.5       5.5       5.5       5.5       5.5       5.5       5.5       5.5
       5.7       5.7       5.7       5.7       5.7       5.7       5.7       5.7
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
6.0       6.0       6.0       6.0       6.0       6.0       6.0       6.0
   0.0       0.0       0.0       0.0       0.0
1428.0      77.0      41.0      21.0       0.0
   0.0       0.0       0.0       0.0       0.0
  41.0      10.0      25.0      15.0       0.0
13 5
DATA FOR EVAPO, PLACE, LAT,DALITE,FACTOR,T,NT,AVCENT
    DULUTH SITE - - SOILS 4       INPUT OUTPUT EXAMPLE
  47.5          APPROX LATTITUDE


      0.0       0.1       0.2       1.0
     32.0      40.0      50.0     100.0
    4
 T
DATA FOR SOWAT
     .400     1.000      .050    24.000
  +.8000E-08  +.1000E-07  +.1500E-07  +.2000E-07  +.2800E-07  +.3800E-07
   .5200E-07   .7000E-07   .9600E-07   .1300E-06   .1700E-06   .2300E-06
   .3200E-06   .4400E-06   .6000E-06   .8100E-06   .1100E-05   .1500E-05
   .2100E-05   .2900E-05   .3800E-05   .5400E-05   .7200E-05   .9900E-05
   .1400E-04   .1900E-04   .2500F-04   .3500E-04   .4800E-04   .6500E-04
   .9000E-04   .1200E-03   .1700F-03   .2300E-03   .3200E-03   .4400E-03
   .5800E-03   .7000E-03   .8600E-03   .1000E-02   .1200E-02   .1500E-02
   .1800E-02   .2200E-02   .2600E-02   .3200E-02   .3800E-02   .4600E-02
   .5600E-02   .6600E-02   .8000E-02   .9800E-02   .1200E-01   .1200E-01
   .1000E+11   .0000E-00   .0000E-00   .0000E-00   .0000E-00   .0000E-00
   .000E-00    .150E+02    .450E+02    .100E+03    .200E+03    .000E-00
    .0024      .0100   7.600000000.0010   10.0000      .0500    24.000
    VARIABLES THROUGH D READ IN
    7.6
  -.500E+06  0.000E-00
  -.220E+05  0.000E-00
   T
   4    5   99    9   54    0
  -.820E+03  -.500E+03  -.200E+03  -.100E+03  -.800E+02  -.400E+02
  -.300E+02  -.265E+02  -.240E+02  -.215E+02  -.210E+02  -.190E+02
  -.175E+02  -.160E+02  -.150E+02  -.110E+02  -.800E+01  -.500E+01
  -.400E+01  -.290E+01  -.220E+01  -.170E+01  -.140E+01  -.115E+01
  -.100E+01  -.900E+00  -.820E+00  -.750E+00  -.700E+00  -.610E+00
  -.580E+00  -.500E+00  -.470E+00  -.410E+00  -.380E+00  -.330E+00
  -.300E+00  -.290E+00  -.250E+00  -.220E+00  -.210E+00  -.190E+00
  -.180E+00  -.130E+00  -.110E+00  -.900E-01  -.800E-01  -.600E-01
  -.400E-01  -.200E-01  -.100E-01  -.100E-02  -.000E+00  +.100E+10
   .000E-00   .000E-00   .000E-00   .000E-00   .000E-00   .000E-00
    .000       .694       .272       .034       .000       .000
   1.05
    VARIABLES THROUGH  R  READ IN
   .100E+01   .200E+01   .300E+01   .100E+02   .000E-00   .000E-00
     1.0        0.0        1.0        0.0        1.0
     .400       .400       .300       .300       .250
     .010       .010       .010       .010       .010       .000
     .520       .520       .520       .520       .520       .000
SOWAT VARIABLES READ IN
```

```
DATA FOR DEGREE- BEGTEM,CV,CONDUC,DTIME,DEG,NDEG,DO
20.0       20.0       20.0       20.0       20.0       20.0
      0.3        0.3        0.3        0.3        0.3        0.3
3.6        3.6        3.6        3.6        3.6        3.6
24.0
   0
  0.00000  15.00000  45.00000 100.00000 200.000001000.00000
DATA FOR NITRO
16.00      16.00      0.50
  70.        70.        70.       150.
  44.        44.        44.        50.
  44.        44.        44.        50.
  77.        77.        77.        15.
   0.0        0.0        0.0        0.0
  .100E-00   .100E+01   .100E-00   .300E-00   .500E-03   .500E-03
     VARIABLES THROUGH  B  READ IN
2.0
   0.00       0.00       0.00       0.0
   0.10       0.10       0.10       0.10
   0.15       0.15       0.15000    0.15
   0.10       0.10       0.10       0.10
   0.30       0.30       0.30       0.30
   0.05       0.05       0.05       0.05
  -.100E-04
  .100E+02   .100E+05   .100E+03   .100E+04   .100E+04   .100E+05   .100E+04
.02        .02        .02        .02        .02
.002       .002       .002       .002       .002
0.01
  0.3        0.3        0.15       1.5        0.0001
 T
     VARIABLES THROUGH  H  READ IN
   1    3    2    1    3    4    5    1
     VARIABLES IAGN,ICO2,INH4,INIT,INO2,INO3,IR,KA READ IN
1.0        1.0        1.0        1.0
   9
  .500E-04   .500E-04
   1
 0.0        0.0        0.0        0.0        0.0
 7.0        7.0        7.0        7.0        7.0
 9.0        9.0        9.0        9.0        9.0
11.0       11.0       11.0       11.0       11.0
9.0        7.0
     VARIABLES THROUGH  P  READ IN
 0.0        0.0        0.0        0.0        0.0
 0.0        0.0        0.0        0.0        0.0
 4.0        4.0        4.0        4.0        4.0
10.0       10.0       10.0       10.0       10.0
 T
00.0       00.0       00.0       00.0       00.0
25.0       25.0       25.0       25.0       25.0
35.0       35.0       35.0       35.0       35.0
45.0       45.0       45.0       45.0       45.0
50.0       10.0
0.85
 T
-15.0      -15.0      -15.0      -15.0      -15.0
 -2.0       -2.0       -2.0       -2.0       -2.0
  -.1        -.1        -.1        -.1        -.1
  0.0        0.0        0.0        0.0        0.0
 F
NITRO DATA READ IN
DATA FOR DECOMP
  .125E+02   .100E-03   .100E-00
```

```
0.0        1.0        0.1        0.3
   .200E+04   .200E+03   .220E+01   .100E+01   .200E+02   .200E+02
   .200E+02   .200E+02   .000E-00   .000E-00   .000E-00
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05

0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.00       0.10       0.15       0.10       0.30       0.05
0.02       0.002
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06  0.100E+06
0.2
.08        .18        .18        .18        .18        .18
     VARIABLES THROUGH E READ IN
.05        .05        .01        .05        .05        .03
.00        .00        .00        .00        .00        .00
   1    4    2    1    3    1    4    1
     VARIABLES THROUGH KA READ IN
 5.        5.         5.         5.         20.
10.        2.         5.         0.          0.
10000.     10000.
5.0        5.0        5.0        5.0        5.0
5.0        5.0        5.0        5.0        5.0
.0005
   1    4    2
4.0
     VARIABLES THROUGH PC2PN READ IN
 0.0        6.0        8.0       10.0
0.0        7.0        8.0        9.50
 0.0        0.0        4.0       10.0
 0.0       25.0       35.0       50.0
 0.0       30.0       35.0       45.0
-15.0      -14.0       -2.0        0.0
-15.0        0.0        0.0        0.0
 F
DECOMP DATA READ IN



  92   94
 30.0 10.0                                                                      1955


       3.0        4.0        9.5       15.0       20.0       25.0       29.0       25.0
      20.0       15.0        9.5        4.0
     -10.0       -6.0       -2.0        2.0        7.0       11.0       15.0       11.0
       7.0        2.0       -2.0       -6.0
```

Output Example

```
             INPUT - OUTPUT EXAMPLE   SOILS 4   DULUTH SITE

       C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY

       C     APRIL 1975      PAUL W. LOMMEN

       SOILS 4 IS BASICALLY RADFORD'S SOILS3 + HANK'S SOWAT + PARNAS' NITRO & DECOMP.


   DATA - - SOILS 4    I/O EXAMPLE   4-75   PAUL LOMMEN
   SCALARS
       AHFAC,BHFAC,EWNUT,EWORG,FRZWNS,FRZWS, FWMAX,FWMAXC,FWMAXE,H2WFAC
       ICF,ICRS,IDAYBS,IDUM,IEN,IFF,INAM,IS,ISALT,ISF,ITUWF,IVH,IX,JDUM,JSALT,JVH
       KA,KG,KS,L1,MTU,NDEP,NDIVLS,NLDIVS,NS,NSTORM,NTUWF,NVC,NVNODS,NVR
       POTDRY,POTWET,RUNFAC,SC2SD,SM2RN,SNOMIN,SNOMXE,SNOWAT,SWRFAC,V2APCT,WERFAC
   VECTORS
       AVINRT,BC,CFEPCT,COVFAC,CPRATE,CTRANS,DEPERO,DFAC
       EFAC,EMOIRT,EMLIT,ERODED,GTU,HORWT,HRTFAC,HWIDTH,IAG,IEXDAY
       ISEND,IVC,IVNODS,KSAT,L2L,NAMDAY,NGUST,SBFAC,SFLOW,SMFAC
       SMTEMP,STORM,TFAC,VCOVER,VHT,WATER,WATGC
   ARRAYS
       DNITL(15,8)
       L2LDIV(3,5)
       RDF(8,5)
       RTLDIV(8,3,5)
       RTL2L(15,8)
   END READING IN SOILS DATA
   DATA FOR NITRO,DECOMP - P,S,SMIN,MDUM,NZONES - READ FROM SOILS
   DATA FOR EVAPO, PLACE, LAT,DALITE,FACTOR,T,NT,AVCENT
   DATA FOR SOWAT
       VARIABLES THROUGH D READ IN
       VARIABLES THROUGH  R  READ IN
   SOWAT VARIABLES READ IN
 WATER      POTENTIAL   CONDUCTIVITY DIFFUSIVITY      C(I)       DEPTH       W-DEPTH     H-DEPTH     RDF-DEPTH   SE-DEPTH
0.         -.8200E+06  .8000E-08   .2560E-02     .5000E-03  0.          .4000E+00   -.2100E+03  0.          .1300E+02
 .1000E-01 -.5000E+06  .1000E-07   .5780E-02     .5000E-03   .1500E+02  .4000E+00   -.2100E+03   .6940E+00  .2600E+02
 .2000E-01 -.2000E+06  .1500E-07   .1026E-01     .1250E-03   .4500E+02  .3000E+00   -.5800E+03   .2720E+00  .5200E+02
 .3000E-01 -.1000E+06  .2000E-07   .1226E-01     .1250E-03   .1000E+03  .3000E+00   -.5800E+03   .3400E-01  .1733E+03
 .4000E-01 -.8000E+05  .2800E-07   .1282E-01     .1250E-03   .2000E+03  .2500E+00   -.9000E+03  0.          0.
 .5000E-01 -.4000E+05  .3800E-07   .1434E-01
 .6000E-01 -.3000E+05  .5200E-07   .1486E-01
 .7000E-01 -.2650E+05  .7000E-07   .1511E-01
 .8000E-01 -.2400E+05  .9600E-07   .1535E-01
 .9000E-01 -.2150E+05  .1300E-06   .1567E-01
 .1000E+00 -.2100E+05  .1700E-06   .1575E-01
 .1100E+00 -.1900E+05  .2300E-06   .1621E-01
 .1200E+00 -.1750E+05  .3200E-06   .1669E-01
 .1300E+00 -.1600E+05  .4400E-06   .1735E-01
 .1400E+00 -.1500E+05  .6000E-06   .1795E-01
 .1500E+00 -.1100E+05  .8100E-06   .2119E-01
 .1600E+00 -.8000E+04  .1100E-05   .2449E-01
 .1700E+00 -.5000E+04  .1500E-05   .2899E-01
 .1800E+00 -.4000E+04  .2100E-05   .3109E-01
 .1900E+00 -.2900E+04  .2900E-05   .3428E-01
 .2000E+00 -.2200E+04  .3800E-05   .3694E-01
 .2100E+00 -.1700E+04  .5400E-05   .3964E-01
 .2200E+00 -.1400E+04  .7200E-05   .4181E-01
 .2300E+00 -.1150E+04  .9900E-05   .4428E-01
 .2400E+00 -.1000E+04  .1400E-04   .4638E-01
 .2500E+00 -.9000E+03  .1900E-04   .4828E-01
 .2600E+00 -.8200E+03  .2500E-04   .5028E-01
 .2700E+00 -.7500E+03  .3500E-04   .5273E-01
 .2800E+00 -.7000E+03  .4800E-04   .5513E-01
 .2900E+00 -.6100E+03  .6500E-04   .6098E-01
```

```
.3000E+00   -.5800E+03   .9000E-04   .6368E-01
.3100E+00   -.5000E+03   .1200E-03   .7328E-01
.3200E+00   -.4700E+03   .1700E-03   .7838E-01
.3300E+00   -.4100E+03   .2300E-03   .9218E-01
.3400E+00   -.3800E+03   .3200E-03   .1018E+00
.3500E+00   -.3300E+03   .4400E-03   .1238E+00
.3600E+00   -.3000E+03   .5800E-03   .1417E+00
.3700E+00   -.2900E+03   .7000E-03   .1482E+00
.3800E+00   -.2500E+03   .8600E-03   .1826E+00
.3900E+00   -.2200E+03   .1000E-02   .2126E+00
.4000E+00   -.2100E+03   .1200E-02   .2246E+00
.4100E+00   -.1900E+03   .1500E-02   .2546E+00
.4200E+00   -.1800E+03   .1800E-02   .2726E+00
.4300E+00   -.1300E+03   .2200E-02   .3826E+00
.4400E+00   -.1100E+03   .2600E-02   .4346E+00
.4500E+00   -.9000E+02   .3200E-02   .4986E+00
.4600E+00   -.8000E+02   .3800E-02   .5366E+00
.4700E+00   -.6000E+02   .4600E-02   .6286E+00
.4800E+00   -.4000E+02   .5600E-02   .7406E+00
.4900E+00   -.2000E+02   .6600E-02   .8726E+00
.5000E+00   -.1000F+02   .8000E-02   .9526F+00
.5100E+00   -.1000E+01   .9800E-02   .1041E+01
.5200E+00   0.           .1200E-01   .1053F+01
.5300E+00    .1000E+13   .1200E-01   .1200E+11
DELX        DETT        GRAVY        CONQ         DELW         TIME
.7600E+01   .2400E-02   .7600E+01   .5000E-01   .1000E-01 0.
TT          CUMT         TAA          HLDW         HHI          RRES
.1000E+01   .2400E+02   .1000E+01 -.2200E+05 0.             .1050E+01
HDRY        HWFT         WATL(KK)     WATH(KK)     CR
-.5000E+00 0.           .1000E-01   .5200E+00   .1000E-01   .5200E+00   .1000E-01   .5200F+00   .1000E-01   .5200E+00   .1000E-01
.5200E+00  .1000E+01
 ALAMBA      SOURCE       DIFU         DIFA         DIFB         SOCUN
.4000E+00   0.           .5000E-01   .1000E-02   .1000F+02   .1000E+01
   DATA FOR DEGREE- BEGTEM,CV,CONDUC,DTIME,DEG,NDFG,DD
   DATA FOR NITRO
         VARIABLES THROUGH  B  READ IN
         VARIABLES THROUGH  H  READ IN
         VARIABLES IAGN,ICO2,INH4,INIT,INO2,INO3,IR,KA READ IN
         VARIABLES THROUGH  P  READ IN
   NITRO DATA READ IN
   DATA FOR DECOMP
         VARIABLES THROUGH E READ IN
         VARIABLES THROUGH KA READ IN
         VARIABLES THROUGH PC2PN READ IN
   DECOMP DATA READ IN

   INPUT - OUTPUT EXAMPLE      SOILS 4

INITIAL REPORT ON APR   1 1955                                                                          2.667 SECONDS ELAPSED

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE
   TYPE OF MATERIAL          NITROGEN     SALTS      PROTEIN C    RESERVE C   STRUCTURAL C   TOTAL C    DRY MATTER
DEAD ROOTS                   10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
GRASS DEAD                   10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
BROADLEAF HERB. DEAD         10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
BROADLEAF WOODY DEAD         10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
EPHEDRA STANDING DEAD        10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
HERBACEOUS SURFACE LITTE     10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
WOODY SURFACE LITTER         10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
DEAD ROOTS 0-15CM            10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
DEAD ROOTS 15-45CM           10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
DEAD ROOTS 45-100 CM         10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
DEAD ROOTS 100-200 CM        10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    278800.00
DUMMY MICROBES(N)             1000.00     1000.00    10000.00    10000.00     10000.00     30000.00     62800.00
DUMMY MICROBES(D)          1100000.00  1100000.00  1100000.00  1100000.00   1100000.00   3300000.00   8888000.00
      TOTAL                1211000.00  1211000.00  1220000.00  1220000.00   2210000.00   4650000.00  12017600.00

SOIL VARIABLES
                             NITROGEN     SALTS      PROTEIN C    RESERVE C   STRUCTURAL CTOTAL C     ORG.D.M.
ORGANIC MATTER CONSTITUENTS
  FROM    0. TO  150. MM.    10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    310000.00
  FROM 150. TO  450. MM.     10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    310000.00
  FROM 450. TO 1000. MM.     10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    310000.00
  FROM1000. TO 2000. MM.     10000.00    10000.00    10000.00    10000.00    100000.00    120000.00    310000.00
       TOTAL                 40000.00    40000.00    40000.00    40000.00    400000.00    480000.00   1240000.00
IN MINERAL FRACTION
  FROM    0. TO  150. MM.    10000.00    10000.00
  FROM 150. TO  450. MM.     10000.00    10000.00
  FROM 450. TO 1000. MM.     10000.00    10000.00
  FROM1000. TO 2000. MM.     10000.00    10000.00
       TOTAL                 40000.00    40000.00

TOTAL, SOIL AND DEAD
   ORGANIC MATERIAL        1291000.00  1291000.00  1260000.00  1260000.00  2610000.00  5130000.00 13257600.00

TOTAL IN ECOSYSTEM         1291000.00  1291000.00  1260000.00  1260000.00  2610000.00  5130000.00 13257600.00

SOIL WATER POTENTIAL, ATM.
  FROM    0. TO  150. MM.      -10.00
  FROM 150. TO  450. MM.       -10.00
  FROM 450. TO 1000. MM.       -10.00
  FROM1000. TO 2000. MM.       -10.00                                                                   0.133 SECONDS ELAPSED
   DEPTH      WATER       POTENTIAL   ROOT EXT.      SALT CONC    AMT SALT    TEMP AT MID-HORIZ
    0.0      0.3724     -.2806E+03   0.              0.00       0.00          0.00
   15.0      0.3910     -.2190E+03   0.             26.08      10.20          0.00
   45.0      0.3030     -.5556E+03   0.             51.90      15.73          0.00
  100.0      0.3000     -.5796E+03   0.            173.32      52.00          0.00
  200.0      0.3168     -.4796E+03   0.              0.00       0.00
   DAY   CUM. HOURS  ET            EUR          CUM.TRANS.   RUNOFF        HROOT         CWF          CUMS
    91   .2400E+02  -.2899E-02  -.2899E-02   0.             0.          -.1000E+04   -.6959E-01   -.6959E-01


  1   .3250E+00   .7252E+01   .1219E+02   .7050E+01   0.            .6072E-01   .1479E+02   0.          .7324E-08   0.
  2   .1166E+00   .1446E-01   .1806E+00   .1280E-01   0.            .4985E-03   .6572E+01   0.          .1802E-09   0.
  3   .1166E+00   .1318E-01   .2129E+00   .8189E-02   0.            .1498E-02   .5183E+01   0.          .3927E-11   0.
  4   .6047E-01   .6363E-02   .1831E+00   .3712E-02   0.            .7954E-03   .2689E+01   0.          .1208E-11   0.
  .201E+04    .201E+03    .221E+01    .100F+01    .200E+02     .200E+02    .200E+02    .200E+02   0.            0.

  0.
SMIN       0.0000   1428.0000      0.0000     41.0000
SMIN       0.0000     77.0000      0.0000     10.0000
SMIN       0.0000     41.0000      0.0000     25.0000
SMIN       0.0000     21.0000      0.0000     15.0000

SOILS  DEBUGGING       IYRDAY =  91
WATER=,PCTSAT=,WATABS=   -0.24     0.00    57.25    -0.38     0.00  104.11   -0.55     0.00  165.85   -0.51    0.00  308.42
H2OQQQ AND EROQQQ  =           0.0000              0.0000            0.0000           0.0000          0.0000         0.0000
CLITQQ =      -998.00     -20.00     -40.00     -40.00     -40.00     -40.16      59.38      59.38     262.09     600.00
CLITQQ =       150.00       0.00       1.86   -1000.00     -10.00     -30.00     -30.00     -30.00     -30.10      69.56
CLITQQ =        59.56     250.28     600.00     150.00       0.00      -0.40   -1000.00     -10.00     -30.01     -30.01
CLITQQ =       -30.00     -30.48      67.94      57.94     250.24     600.00     150.00       0.00       0.73   -1000.00
CLITQQ =       -10.00     -30.01     -30.01     -30.01     -30.48      67.94      57.94     250.07     600.00     150.00
CLITQQ =         0.00       0.93  -10000.00    -100.03    -300.17    -300.17    -300.10    -304.79     679.40     579.40
CLITQQ =      2498.34    5999.97    1499.99       0.00      12.12
CURGQQ =        -0.29       0.04       0.12       0.06      -0.00      -0.13      -0.13      -0.14      -1.40      -0.37
CURGQQ =        -0.20      -0.21      -1.62      -0.34      -0.14      -0.14     -19.28      -2.89      -0.43      -0.43
CHINQQ =        -7.12      -0.02      -0.01      -0.01     -20.23      -6.46      -5.19      -2.69      14.78       6.57
CHINQQ =         5.18       2.69      -0.06      -0.00      -0.00      -0.00       0.00       0.00       0.00       0.00
SHINQQ=          0.00       0.00       0.00       0.00     -21.68      -6.58      -5.19      -2.69      14.78       6.57
SHINQQ=          5.18       2.69      -0.06      -0.00      -0.00      -0.00
AGAINQ =       -52.37       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00
   DEPTH        WATER       POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT    TEMP AT MID-HORIZ
```

```
    0.0     0.5200      0.             0.                    0.00      0.00           12.03
   15.0     0.3934      -.2166E+03     0.                   25.90     10.19           17.40
   45.0     0.3032      -.5546E+03     0.                   51.90     15.73           19.60
  100.0     0.3000      -.5796E+03     0.                  173.32     52.01           19.96
  200.0     0.3168      -.4796E+03     0.                    0.00      0.00
 DAY   CUM. HOURS  ET              EOR          CUM.TRANS.   RUNOFF      HROUT        CWF          CUMS
  92   .1000E+01   0.              .9240E-01    0.           .3304E+00   -.1000E+04   -.1023E-01   .5936E-01

 DEPTH         WATER       POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT     TEMP AT MID-HORIZ
    0.0     0.5200      0.             0.                    0.00      0.00           12.03
   15.0     0.3958      -.2142E+03     0.                   25.72     10.18           17.40
   45.0     0.3033      -.5536E+03     0.                   51.89     15.74           19.60
  100.0     0.3001      -.5796E+03     0.                  173.32     52.01           19.96
  200.0     0.3168      -.4796E+03     0.                    0.00      0.00
 DAY   CUM. HOURS  ET              EOR          CUM.TRANS.   RUNOFF      HROUT        CWF          CUMS
  92   .1000E+01   0.              .9240E-01    0.           .3299E+00   -.1000E+04   .4919E-01    .5941E-01

 DEPTH         WATER       POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT     TEMP AT MID-HORIZ
    0.0     0.5200      0.             0.                    0.00      0.00           12.03
   15.0     0.3982      -.2118E+03     0.                   25.54     10.17           17.40
   45.0     0.3034      -.5526E+03     0.                   51.89     15.74           19.60
  100.0     0.3001      -.5796E+03     0.                  173.32     52.01           19.96
  200.0     0.3168      -.4796E+03     0.                    0.00      0.00
 DAY   CUM. HOURS  ET              EOR          CUM.TRANS.   RUNOFF      HROUT        CWF          CUMS
  92   .1000E+01   0.              .9240E-01    0.           .3315E+00   -.1000E+04   .1084E+00    .5925E-01

 DEPTH         WATER       POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT     TEMP AT MID-HORIZ
    0.0     0.5200      0.             0.                    0.00      0.00           12.03
   15.0     0.4782      -.4368E+02     0.                   20.26      9.69           17.40
   45.0     0.3113      -.4960E+03     0.                   51.62     16.07           19.60
  100.0     0.3001      -.5791E+03     0.                  173.31     52.01           19.96
  200.0     0.3170      -.4791E+03     0.                    0.00      0.00
 DAY   CUM. HOURS  ET              EOR          CUM.TRANS.   RUNOFF      HROUT        CWF          CUMS
  92   .2100E+02   0.              0.           0.           0.          -.1000E+04   .2250E+01    .2141E+01
 1   .5786E-01   .6496E+01   .1094E+02   .6249E+01   .6567E-02   .5457E-01   .1074E+02   .3545E+01   .8100E-07  0.
 2   .2779E-01   .1373E-01   .1715E+00   .1111E-01   .1037E-03   .4733E-03   .5743E+01   .1022E+01   .3901E-09  0.
 3   .2784E-01   .1346E-01   .2175E+00   .7306E-02   .1057E-03   .1530E-02   .4605E+01   .1015E+01   .4875E-11  0.
 4   .3405E-01   .5125E-02   .1475E+00   .2607E-02   .3827E-04   .6407E-03   .1901E+01   .6764E-01   .1281E-10  0.
  .202E+04    .201E+03    .222E+01    .100E+01    .199E+02    .200E+02    .200E+02    .200E+02   0.          0.
  0.
SMIN      0.0000   1406.3169     14.7806     40.9376
SMIN      0.0000     70.4244      6.5697      9.9995
SMIN      0.0000     35.0090      5.1809     24.9985
SMIN      0.0000     18.3074      2.6879     14.9992

SOILS  DEBUGGING       IYRDAY =  92
WATER=,PCTSAT=,WATABS=   -0.02     0.00    74.86    -0.26     0.00  118.43    -0.52     0.00  168.15    -0.51     0.00  308.55
H2OQQQ AND ERNDQQ  =     277200000.0000             0.0000   -99172363.7776              0.0000             0.0000            0.0000
CLITQQ =     -898.40      -19.96      -39.85      -39.85      -39.84      -40.00       59.05       59.12      236.32      540.12
CLITQQ =      135.03        0.00        1.91     -900.00       -9.99      -29.91      -29.91      -29.91      -30.02       69.35
CLITQQ =       59.36      225.66      540.00      135.00        0.00       -0.40     -900.00       -9.99      -29.92      -29.92
CLITQQ =      -29.92      -30.40       67.68       57.69      225.81      540.00      135.00        0.00        0.77     -900.00
CLITQQ =       -9.99      -29.93      -29.93      -29.92      -30.40       67.68       57.69      225.45      540.00      135.00
CLITQQ =        0.00        0.97    -9000.00      -99.93     -299.29     -299.29     -299.21     -303.99      676.82      576.91
CLITQQ =     2249.47     5399.97     1349.99        0.00       12.53
CORGQQ =       -0.58       -0.04        0.03        0.03       -0.23       -0.21       -0.23       -0.13       -1.78       -0.49
CORGQQ =       -0.35       -0.19       -1.89       -0.41       -0.23       -0.13      -20.53       -3.08       -0.72       -0.39
CMINQQ =       -6.32       -0.01       -0.01       -0.00      -15.34       -5.63       -4.61       -1.90        7.19        4.72
CMINQQ =        3.59        1.83        3.49        1.02        1.01        0.07        0.00        0.00        0.00        0.00
SMINQQ=         0.00        0.00        0.00        0.00      -16.83       -5.74       -4.61       -1.90        7.19        4.72
SMINQQ=         3.59        1.83        3.49        1.02        1.01        0.07
AGAINQ =      -52.94        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00
   DEPTH         WATER       POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT     TEMP AT MID-HORIZ
     0.0     0.4386      -.1128E+03     0.                   0.00      0.00           10.97
    15.0     0.4553      -.8469E+02     0.                  19.95      9.08           15.88
    45.0     0.3216      -.4606E+03     0.                  51.25     16.48           19.09
   100.0     0.3002      -.5781E+03     0.                 173.29     52.03           19.92
   200.0     0.3173      -.4781E+03     0.                   0.00      0.00
   DAY   CUM. HOURS  ET           EOR          CUM.TRANS.   RUNOFF      HROUT        CWF          CUMS
    93   .2400E+02   -.2928E-02   -.2928E-02   0.           0.          -.1000E+04   .2180E+01    -.7026E-01

 1   .5820E-01   .5766E+01   .9727E+01   .5503E+01   .8701E-02   .5279E-01   .5782E+00   .3336E+00   .1063E-08  0.
 2   .2817E-01   .1334E-01   .1667E+00   .9922E-02   .1732E-03   .5072E-03   .5153E+01   .1626E+01   .4866E-09  0.
 3   .2830E-01   .1372E-01   .2217E+00   .6488E-02   .1824E-03   .1623E-02   .4063E+01   .1652E+01   .5661E-11  0.
 4   .3430E-01   .2744E-03   .7899E-02   .1251E-03   .3447E-05   .3446E-04   .1293E+00   .1217E-01   .1652E-12  0.
  .203E+04    .202E+03    .222E+01    .100E+01    .199E+02    .200E+02    .200E+02    .200E+02   0.          0.
  0.
SMIN      0.0000   1389.4821     21.9685     44.4252
SMIN      0.0000     64.6802     11.2875     11.0210
SMIN      0.0000     31.1969      8.7688     26.0118
SMIN      0.0000     16.4035      4.5208     15.0662

SOILS  DEBUGGING       IYRDAY =  93
WATER=,PCTSAT=,WATABS=   -0.10     0.00    67.04    -0.26     0.00  116.53    -0.50     0.00  171.00    -0.51     0.00  308.76
H2OQQQ AND ERNDQQ  =          0.0000             0.0000             0.0000             0.0000             0.0000            0.0000
CLITQQ =     -808.74      -19.92      -39.69      -39.69      -39.68      -39.83       58.77       58.93      212.50      486.22
CLITQQ =      121.55        0.00        1.76     -810.00       -9.98      -29.82      -29.82      -29.82      -29.92       69.20
CLITQQ =       59.22      202.79      486.00  .   121.50        0.00       -0.40     -810.00       -9.98      -29.83      -29.83
CLITQQ =      -29.83      -30.27       67.65       57.67      202.76      486.00      121.50        0.00        0.66     -810.00
CLITQQ =       -9.98      -29.84      -29.84      -29.83      -30.27       67.65       57.67      202.59      486.00      121.50
CLITQQ =        0.00        0.87    -8100.00      -99.83     -298.38     -298.38     -298.31     -302.74      676.54      576.71
CLITQQ =     2023.49     4859.97     1214.99        0.00       11.48
CORGQQ =       -0.53       -0.04        0.03        0.03        0.03       -0.20       -0.23        0.03       -1.28       -0.46
CORGQQ =       -0.35        0.04       -1.51       -0.39       -0.24        0.03      -18.21       -2.91       -0.73        0.07
CMINQQ =       -5.57       -0.01       -0.01       -0.00       -4.55       -5.05       -4.07       -0.13        0.24        3.53
CMINQQ =        2.41        0.12        0.28        1.62        1.65        0.01        0.00        0.00        0.00        0.00
SMINQQ=         0.00        0.00        0.00        0.00       -5.93       -5.15       -4.07       -0.13        0.24        3.53
SMINQQ=         2.41        0.12        0.28        1.62        1.65        0.01
AGAINQ =      -53.60        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00
   DEPTH         WATER       POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT     TEMP AT MID-HORIZ
     0.0     0.4263      -.1485E+03     0.                   0.00      0.00           10.42
    15.0     0.4374      -.1152E+03     0.                  19.74      8.63           14.90
    45.0     0.3291      -.4155E+03     0.                  50.96     16.77           18.58
   100.0     0.3004      -.5767E+03     0.                 173.26     52.05           19.84
   200.0     0.3178      -.4767E+03     0.                   0.00      0.00
   DAY   CUM. HOURS  ET           EOR          CUM.TRANS.   RUNOFF      HROUT        CWF          CUMS
    94   .2400E+02   -.2941E-02   -.2941E-02   0.           0.          -.1000E+04   .2109E+01    -.7059E-01

 1   .5811E-01   .5276E+01   .8914E+01   .5033E+01   .8077E-02   .4879E-01   .1262E+02   .6113E+01   .1883E-07  0.
 2   .2853E-01   .1315E-01   .1644E+00   .9001E-02   .2240E-03   .5736E-03   .4693E+01   .2021E+01   .5854E-09  0.
 3   .2876E-01   .1398E-01   .2259E+00   .5750E-02   .2369E-03   .1759E-02   .3569E+01   .2042E+01   .6452E-11  0.
 4   .3425E-01   .6610E-02   .1903E+00   .2989E-02   .8518E-04   .8307E-03   .2171E+01   .1408E+00   .3007E-11  0.
  .204E+04    .202E+03    .223E+01    .100E+01    .199E+02    .200E+02    .200E+02    .199E+02   0.          0.
  0.
SMIN      0.0000   1383.5544     22.2040     44.7043
SMIN      0.0000     59.5265     14.8127     12.6456
SMIN      0.0000     27.1276     11.1780     27.6614
SMIN      0.0000     16.2741      4.6379     15.0783

SOILS  DEBUGGING       IYRDAY =  94
WATER=,PCTSAT=,WATABS=   -0.13     0.00    64.78    -0.26     0.00  114.97    -0.48     0.00  173.11    -0.51     0.00  309.08
H2OQQQ AND ERNDQQ  =          0.0000             0.0000             0.0000             0.0000             0.0000            0.0000
CLITQQ =     -728.03      -19.88      -39.53      -39.53      -39.53      -39.67       58.48       58.72      191.66      437.69
CLITQQ =      109.42        0.00        1.69     -729.00       -9.97      -29.73      -29.73      -29.73      -29.83       69.02
CLITQQ =       59.05      183.01      437.40      109.35        0.00       -0.40     -729.00       -9.97      -29.74      -29.74
CLITQQ =      -29.74      -30.17       67.54       57.57      183.22      437.40      109.35        0.00        0.61     -729.00
CLITQQ =       -9.97      -29.75      -29.75      -29.74      -30.17       67.54       57.57      182.82      437.40      109.35
CLITQQ =        0.00        0.82    -7290.00      -99.73     -297.48     -297.48     -297.41     -301.67      675.39      575.65
```

```
CLITQQ =    1822.47     4373.97     1093.49        0.00       10.99
CORGQQ =      -0.50       -0.04        0.03        0.03       -0.23       -0.19       -0.24       -0.17       -1.61       -0.45
CORGQQ =      -0.36       -0.26       -1.70       -0.38       -0.24       -0.17      -18.23       -2.81       -0.74       -0.52
CMINQQ =      -5.10       -0.01       -0.01       -0.00      -16.17       -4.59       -3.57       -2.17        6.49        2.67
CMINQQ =       1.53        2.03        6.06        2.02        2.04        0.14        0.00        0.00        0.00        0.00
SMINQQ=        0.00        0.00        0.00        0.00      -17.50       -4.69       -3.57       -2.17        6.49        2.67
SMINQQ=        1.53        2.03        6.06        2.02        2.04        0.14
AGAINQ =     -53.80        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00
  DEPTH       WATER      POTENTIAL    ROOT EXT.   SALT CONC    AMT SALT    TEMP AT MID-HORIZ
    0.0     0.4051     -.1997E+03    0.                0.00        0.00         10.11
   15.0     0.4234     -.1632E+03    0.               19.62        8.31         14.20
   45.0     0.3344     -.3967E+03    0.               50.73       16.97         18.11
  100.0     0.3006     -.5750E+03    0.              173.23       52.08         19.75
  200.0     0.3183     -.4750E+03    0.                0.00        0.00
  DAY   CUM. HOURS  ET            EOR          CUM.TRANS.   RUNOFF        HROOT       CWF          CUMS
   95   .2400E+02  -.2955E-02  -.2955E-02   0.             0.          -.1000E+04   .2038E+01  -.7093E-01

  1   .5856E-01   .4752E+01   .8039E+01   .4491E+01   .9434E-02   .5006E-01   .1247E+02   .7682E+01   .1580E-07  0.
  2   .2889E-01   .1307E-01   .1634E+00   .8242E-02   .2628E-03   .6613E-03   .4310E+01   .2289E+01   .6245E-09  0.
  3   .2924E-01   .1426E-01   .2304E+00   .5091E-02   .2746E-03   .1926E-02   .3125E+01   .2261E+01   .7030E-11  0.
  4   .3459E-01   .6756E-02   .1945E+00   .2647E-02   .1252E-03   .8571E-03   .1921E+01   .1991E+00   .2424E-11  0.
   .204E+04    .203E+03    .224E+01    .101E+01    .198E+02    .200E+02    .200E+02    .199E+02   0.          0.
  0.
SMIN      0.0000   1366.0528    28.6973    50.7650
SMIN      0.0000     54.8336    17.4828    14.6651
SMIN      0.0000     23.5529    12.7035    29.7008
SMIN      0.0000     14.1002     6.6672    15.2182

SOILS  DEBUGGING      IYRDAY =  95
WATER=,PCTSAT=,WATABS=   -0.18    0.00   62.14   -0.27    0.00  113.67   -0.47    0.00  174.64   -0.51    0.00  309.49
H2OQQQ AND ERODQQ  =          0.0000            0.0000            0.0000            0.0000            0.0000            0.0000
CLITQQ =    -655.38      -19.84      -39.37      -39.37      -39.37      -39.50       58.18       58.50      172.60      394.01
CLITQQ =      98.50        0.00        1.63     -656.10       -9.96      -29.64      -29.64      -29.64      -29.73       68.85
CLITQQ =      58.89      164.80      393.66       98.41        0.00       -0.41     -656.10       -9.96      -29.65      -29.65
CLITQQ =     -29.65      -30.06       67.42       57.46      165.02      393.66       98.41        0.00        0.57     -656.10
CLITQQ =      -9.96      -29.66      -29.66      -29.65      -30.06       67.42       57.46      164.61      393.66       98.41
CLITQQ =       0.00        0.77    -6561.00      -99.63     -296.58     -296.58     -296.52     -300.62      674.20      574.55
CLITQQ =    1640.33     3936.57      984.14        0.00       10.53
CORGQQ =      -0.48       -0.03        0.03        0.03       -0.22       -0.19       -0.24       -0.17       -1.55       -0.43
CORGQQ =      -0.36       -0.26       -1.63       -0.37       -0.24       -0.18      -17.51       -2.70       -0.75       -0.53
CMINQQ =      -4.56       -0.01       -0.01       -0.00      -15.54       -4.21       -3.13       -1.92        4.78        2.02
CMINQQ =       0.86        1.72        7.63        2.29        2.26        0.20        0.00        0.00        0.00        0.00
SMINQQ=        0.00        0.00        0.00        0.00      -16.82       -4.31       -3.13       -1.92        4.78        2.02
SMINQQ=        0.86        1.72        7.63        2.29        2.26        0.20
AGAINQ =     -54.16        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00
  DEPTH       WATER      POTENTIAL    ROOT EXT.   SALT CONC    AMT SALT    TEMP AT MID-HORIZ
    0.0     0.3846     -.2362E+03    0.                0.00        0.00          9.91
   15.0     0.4131     -.1869E+03    0.               19.60        8.09         13.67
   45.0     0.3377     -.3868E+03    0.               50.56       17.08         17.68
  100.0     0.3009     -.5730E+03    0.              173.19       52.11         19.65
  200.0     0.3190     -.4730E+03    0.                0.00        0.00
  DAY   CUM. HOURS  ET            EOR          CUM.TRANS.   RUNOFF        HROOT       CWF          CUMS
   96   .2400E+02  -.2969E-02  -.2969E-02   0.             0.          -.1000E+04   .1967E+01  -.7126E-01

  1   .5903E-01   .4282E+01   .7253E+01   .4009E+01   .9946E-02   .5205E-01   .1240E+02   .8795E+01   .1533E-07  0.
  2   .2925E-01   .1307E-01   .1634E+00   .7593E-02   .2931E-03   .7643E-03   .3979E+01   .2471E+01   .6692E-09  0.
  3   .2971E-01   .1455E-01   .2352E+00   .4506E-02   .2993E-03   .2116E-02   .2729E+01   .2361E+01   .7485E-11  0.
  4   .3494E-01   .6905E-02   .1988E+00   .2337E-02   .1610E-03   .8876E-03   .1691E+01   .2481E+00   .2260E-11  0.
   .205E+04    .203E+03    .225E+01    .101E+01    .198E+02    .200E+02    .200E+02    .199E+02   0.          0.
  0.
SMIN      0.0000   1349.2378    33.4751    58.3926
SMIN      0.0000     50.5241    19.5025    16.9523
SMIN      0.0000     20.4227    13.5661    31.9592
SMIN      0.0000     12.1770     8.3878    15.4164

SOILS  DEBUGGING      IYRDAY =  96
WATER=,PCTSAT=,WATABS=   -0.21    0.00   59.83   -0.28    0.00  112.63   -0.47    0.00  175.62   -0.51    0.00  309.94
H2OQQQ AND ERODQQ  =          0.0000            0.0000            0.0000            0.0000            0.0000            0.0000
CLITQQ =    -589.97      -19.80      -39.21      -39.21      -39.21      -39.34       57.88       58.27      155.43      354.69
CLITQQ =      88.67        0.00        1.59     -590.49       -9.95      -29.55      -29.55      -29.55      -29.64       68.67
CLITQQ =      58.72      148.41      354.29       88.57        0.00       -0.41     -590.49       -9.95      -29.56      -29.56
CLITQQ =     -29.56      -29.96       67.27       57.32      148.64      354.29       88.57        0.00        0.54     -590.49
CLITQQ =      -9.95      -29.57      -29.57      -29.56      -29.96       67.27       57.32      148.23      354.29       88.57
CLITQQ =       0.00        0.74    -5904.90      -99.53     -295.69     -295.69     -295.62     -299.62      672.73      573.17
CLITQQ =    1476.39     3542.91      885.73        0.00       10.25
CORGQQ =      -0.47       -0.03        0.03        0.03       -0.21       -0.18       -0.24       -0.18       -1.51       -0.43
CORGQQ =      -0.36       -0.27       -1.59       -0.36       -0.24       -0.18      -17.07       -2.63       -0.75       -0.54
CMINQQ =      -4.08       -0.01       -0.01       -0.00      -15.01       -3.88       -2.73       -1.69        3.59        1.51
CMINQQ =       0.37        1.44        8.74        2.47        2.36        0.25        0.00        0.00        0.00        0.00
SMINQQ=        0.00        0.00        0.00        0.00      -16.26       -3.98       -2.73       -1.69        3.59        1.51
SMINQQ=        0.37        1.44        8.74        2.47        2.36        0.25
AGAINQ =     -54.46        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00

     INPUT - OUTPUT EXAMPLE       SOILS 4

REPORT NO.   1 ON APR  16 1955 (I.E., AFTER  15 DAYS OF SIMULATION)                              10.200 SECONDS ELAPSED

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE
     TYPE OF MATERIAL           NITROGEN      SALTS       PROTEIN C    RESERVE C   STRUCTURAL C    TOTAL C     DRY MATTER
DEAD ROOTS                       2065.72      2058.91      2058.91      2058.91      20589.11      24706.94      57409.26
GRASS DEAD                       9704.14      9851.09      9851.07      9851.04      98510.01     118212.13     274499.36
BROADLEAF HERB. DEAD             9416.44      9559.33      9559.16      9559.13      95590.88     114709.17     266365.19
BROADLEAF WOODY DEAD             9416.44      9559.33      9559.16      9559.13      95590.88     114709.17     266365.19
EPHEDRA STANDING DEAD            9416.47      9559.35      9559.26      9559.23      95591.87     114710.36     266367.79
HERBACEOUS SURFACE LITTE         9414.49      9558.01      9553.23      9553.23      95532.34     114638.81     266210.21
WOODY SURFACE LITTER            10859.03     11024.51     11003.50     11003.50     110034.97     132041.98     306654.07
DEAD ROOTS 0-15CM               10867.17     10875.53     10854.42     10854.42     108544.20     130253.05     302655.10
DEAD ROOTS 15-45CM              12090.86     11996.45     11999.68     11993.71     119853.58     143846.97     334310.81
DEAD ROOTS 45-100 CM            14770.03     14764.64     14764.60     14764.60     147646.04     177175.25     411642.62
DEAD ROOTS 100-200 CM           11192.51     11191.16     11191.15     11191.15     111911.50     134293.80     312010.63
DUMMY MICROBES(N)                1000.00      1000.00     10000.00     10000.00      10000.00      30000.00      62800.00
DUMMY MICROBES(D)             1100023.79   1099993.85   1100008.01   1100011.08    1100153.81    3300172.89    8888393.84
      TOTAL                   1210237.10   1210992.18   1219962.15   1219959.14    2209549.21    4649470.50   12015684.06

SOIL VARIABLES
                                NITROGEN     SALTS        PROTEIN C    RESERVE C    STRUCTURAL CTOTAL C      ORG.O.M.
ORGANIC MATTER CONSTITUENTS
  FROM    0. TO  150. MM.        9993.26      9997.29      9978.14      9976.65      99745.71     119700.49     309263.65
  FROM 150. TO  450. MM.       . 9999.64      9997.29      9993.71      9994.71      99961.04     119949.46     309876.87
  FROM 450. TO 1000. MM.        10000.54      9996.36      9994.51      9996.33      99988.68     119979.52     309951.18
  FROM1000. TO 2000. MM.        10000.56      9997.48      9996.21      9997.47      99992.31     119985.98     309966.78
      TOTAL                     39994.00     39988.42     39962.57     39965.15     399687.73     479615.45    1239058.48
IN MINERAL FRACTION
  FROM    0. TO  150. MM.        9945.12      9791.72
  FROM 150. TO  450. MM.         9999.64      9946.01
  FROM 450. TO 1000. MM.         9999.87      9963.76
  FROM1000. TO 2000. MM.         9999.95      9981.44
      TOTAL                     39944.78     39682.92

TOTAL, SOIL AND DEAD
    ORGANIC MATERIAL          1290175.88   1290663.52   1260018.95   1259961.55   2609236.94   5129085.95  13254742.55

TOTAL IN ECOSYSTEM            1290175.88   1290663.52   1260018.95   1259961.55   2609236.94   5129085.95  13254742.55


ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM
                                   WATER      MINERAL SOIL ' NITROGEN     SALTS          TOTAL C
 TO OR FROM ATMOSPHERE         277200000.00           0.00     -819.80       0.00           0.00
```

```
BY RUN-OFF OR RUN-ON          -99172363.78          0.00       0.00       0.00       0.00
TO OR FROM SUBSOIL                     0.00          0.00       0.00       0.00       0.00

     TOTAL                     178027636.22          0.00    -819.80       0.00       0.00

SOIL WATER POTENTIAL, ATM.
 FROM    0. TO  150. MM.          -0.37
 FROM  150. TO  450. MM.          -0.32
 FROM  450. TO 1000. MM.          -0.43
 FROM 1000. TO 2000. MM.          -0.48

ACCUMULATED PRECIPITATION =   30.0 MM. - THAT IS,        300.0 TONS PER HECTARE                      0.167 SECONDS ELAPSED
  DEPTH      WATER        POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT    TEMP AT MID-HORIZ
    0.0     0.3132     -.4904E+03    0.                0.00        0.00          9.27
   15.0     0.3513     -.3262E+03    0.               20.59        7.23         11.53
   45.0     0.3472     -.3442E+03    0.               49.33       17.13         15.12
  100.0     0.3042     -.5461E+03    0.              172.71       52.54         18.57
  200.0     0.3240     -.4461E+03    0.                0.00        0.00
  DAY   CUM. HOURS  ET           EOR          CUM.TRANS.   RUNOFF      HROOT        CWF          CUMS
  106   .2400E+02  -.3103E-02   -.3103E-02   0.            0.          -.1000E+04   .1236E+01    -.7447E-01


  1   .6428E-01   .1561E+01   .2663E+01   .1323E+01   .5357E-02   .5515E-01   .1265E+02   .1220E+02   .1633E-07  0.
  2   .3277E-01   .1479E-01   .1848E+00   .3662E-02   .3773E-03   .2205E-02   .1861E+01   .2452E+01   .8800E-09  0.
  3   .3484E-01   .1844E-01   .2983E+00   .1327E-02   .2497E-03   .4383E-02   .6464E+00   .1367E+01   .9575E-11  0.
  4   .3881E-01   .8591E-02   .2476E+00   .5812E-03   .3465E-03   .1363E-02   .3874E+00   .4194E+00   .1650E-11  0.
   .211E+04    .207E+03    .232E+01    .102E+01    .195E+02    .200E+02    .200E+02    .197E+02   0.          0.
  0.
SMIN      0.0000   1200.9507     48.6129    166.8102
SMIN      0.0000     21.5402     22.1927     43.2390
SMIN      0.0000      4.7417      8.9234     52.2082
SMIN      0.0000      2.4321     14.5005     19.0167


     INPUT - OUTPUT EXAMPLE      SOILS 4

REPORT NO.  2 ON MAY   1 1955 (I.E., AFTER  30 DAYS OF SIMULATION)                                     8.767 SECONDS ELAPSED

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE
   TYPE OF MATERIAL          NITROGEN      SALTS      PROTEIN C    RESERVE C   STRUCTURAL C   TOTAL C    DRY MATTER
DEAD ROOTS                     426.69      423.91       423.91       423.91      4239.12      5086.94     11821.44
GRASS DEAD                    9417.05     9704.40      9704.37      9704.31     97042.32    116451.00    270267.38
BROADLEAF HERB. DEAD          8866.95     9138.09      9137.79      9137.74     91376.55    109652.08    254487.97
BROADLEAF WOODY DEAD          8866.95     9138.09      9137.79      9137.74     91376.55    109652.08    254487.97
EPHEDRA STANDING DEAD         8866.99     9138.13      9137.97      9137.91     91378.30    109654.18    254492.57
HERBACEOUS SURFACE LITTE      8863.44     9135.73      9127.21      9127.21     91272.09    109526.50    254211.33
WOODY SURFACE LITTER         11651.50    12008.91     11970.31     11970.31    119702.99    143643.61    333451.79
DEAD ROOTS 0-15CM            11684.50    11713.12     11674.14     11674.14    116741.38    140089.67    325524.32
DEAD ROOTS 15-45CM           12533.39    12420.45     12429.26     12415.35    123958.78    148803.39    345858.08
DEAD ROOTS 45-100 CM         15755.35    15745.63     15745.56     15745.56    157455.55    188946.66    438995.95
DEAD ROOTS 100-200 CM        11438.84    11436.41     11436.39     11436.39    114363.88    137236.66    318848.97
DUMMY MICROBES(N)             1000.00     1000.00     10000.00     10000.00     10000.00     30000.00     62800.00
DUMMY MICROBES(D)          1100043.13  1099987.48   1100012.69   1100018.95   1100277.08   3300308.72   8888703.21
     TOTAL                 1209414.77  1210990.35   1219937.40   1219929.51   2209184.59   4649051.49  12013950.97

SOIL VARIABLES
                             NITROGEN      SALTS      PROTEIN C    RESERVE C   STRUCTURAL CTOTAL C     ORG.D.M.
ORGANIC MATTER CONSTITUENTS
 FROM    0. TO  150. MM.      9987.85     9994.69      9959.88      9957.40     99539.39    119456.67    308664.34
 FROM  150. TO  450. MM.      9999.44     9994.39      9987.53      9989.69     99927.12    119904.34    309767.16
 FROM  450. TO 1000. MM.     10001.12     9991.36      9986.98      9991.29     99973.30    119951.57    309884.42
 FROM 1000. TO 2000. MM.     10001.19     9993.92      9990.86      9993.90     99981.53    119966.29    309919.96
     TOTAL                   39989.60    39974.35     39925.25     39932.29    399421.33    479278.87   1238235.88
IN MINERAL FRACTION
 FROM    0. TO  150. MM.      9933.65     9612.09
 FROM  150. TO  450. MM.      9999.73     9930.89
 FROM  450. TO 1000. MM.      9999.76     9959.56
 FROM 1000. TO 2000. MM.      9999.91     9979.16
     TOTAL                   39933.06    39481.70

TOTAL, SOIL AND DEAD
   ORGANIC MATERIAL        1289337.43  1290446.41   1259939.37   1259932.09   2608605.92   5128330.36  13252186.84

TOTAL IN ECOSYSTEM         1289337.43  1290446.41   1259939.37   1259932.09   2608605.92   5128330.36  13252186.84


ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM
                                  WATER     MINERAL SOIL   NITROGEN     SALTS       TOTAL C
 TO OR FROM ATMOSPHERE      277200000.00         0.00     -1654.22       0.00        0.00
 BY RUN-OFF OR RUN-ON       -99172363.78         0.00         0.00       0.00        0.00
 TO OR FROM SUBSOIL                 0.00         0.00         0.00       0.00        0.00

     TOTAL                  178027636.22         0.00     -1654.22       0.00        0.00

SOIL WATER POTENTIAL, ATM.
 FROM    0. TO  150. MM.          -5.77
 FROM  150. TO  450. MM.          -0.44
 FROM  450. TO 1000. MM.          -0.44
 FROM 1000. TO 2000. MM.          -0.45

ACCUMULATED PRECIPITATION =   30.0 MM. - THAT IS,        300.0 TONS PER HECTARE                      0.150 SECONDS ELAPSED
  DEPTH      WATER        POTENTIAL   ROOT EXT.    SALT CONC    AMT SALT    TEMP AT MID-HORIZ
    0.0     0.0100     -.5000E+06    0.                0.00        0.00          9.05
   15.0     0.3038     -.5494E+03    0.               24.91        7.57         10.69
   45.0     0.3368     -.3896E+03    0.               48.16       16.22         13.58
  100.0     0.3085     -.5118E+03    0.              172.08       53.09         17.55
  200.0     0.3297     -.4118E+03    0.                0.00        0.00
  DAY   CUM. HOURS  ET           EOR          CUM.TRANS.   RUNOFF      HROOT        CWF          CUMS
  121   .2400E+02  -.1953E-01   -.1953E-01   0.            0.          -.1000E+04   .6055E-01    -.1022E+00


  1   .7303E-01   .3304E+00   .5652E+00   .2362E+00   .1232E-02   .2458E-01   .4832E-01   .8515E-01  0.           0.
  2   .3867E-01   .2189E-01   .2735E+00   .1307E-02   .2766E-03   .5344E-02   .5448E+00   .1283E+01   .8120E-09  0.
  3   .4483E-01   .2778E-01   .4501E+00   .2187E-03   .8326E-04   .8018E-02   .7320E-01   .2873E+00   .9599E-11  0.
  4   .4592E-01  0.          0.          0.          0.          0.          .8480E-02   .7355E-02  0.           0.
   .216E+04    .211E+03    .242E+01    .102E+01    .190E+02    .198E+02    .198E+02    .194E+02   0.          0.
  0.
SMIN      0.0000   1005.8145     52.4872    348.9084
SMIN      0.0000      5.1955     10.9950.    70.8009
SMIN      0.0000      0.5177      1.9713     63.2780
SMIN      0.0000      0.1495     11.2707     24.4921


     INPUT - OUTPUT EXAMPLE      SOILS 4

REPORT NO.  3 ON MAY  16 1955 (I.E., AFTER  45 DAYS OF SIMULATION)                                     8.383 SECONDS ELAPSED

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE
   TYPE OF MATERIAL          NITROGEN      SALTS      PROTEIN C    RESERVE C   STRUCTURAL C   TOTAL C    DRY MATTER
DEAD ROOTS                      87.85       87.28        87.28        87.28       872.80      1047.36      2433.93
GRASS DEAD                    9276.77     9559.90      9559.89      9559.81     95596.88    114716.58    266242.00
BROADLEAF HERB. DEAD          8476.20     8735.46      8735.19      8735.11     87349.90    104820.20    243273.79
BROADLEAF WOODY DEAD          8476.20     8735.46      8735.19      8735.11     87349.90    104820.20    243273.79
EPHEDRA STANDING DEAD         8476.24     8735.49      8735.35      8735.27     87351.57    104822.20    243278.19
HERBACEOUS SURFACE LITTE      8472.20     8732.86      8723.70      8723.70     87237.02    104684.43    242974.48
WOODY SURFACE LITTER         12572.59    12958.56     12918.90     12918.89    129188.73    155026.53    359871.69
DEAD ROOTS 0-15CM            12465.15    12518.10     12477.68     12477.68    124776.68    149732.03    347905.33
DEAD ROOTS 15-45CM           12637.48    12516.05     12528.25     12508.26    124802.62    149839.13    348284.91
```

DEAD ROOTS 45-100 CM	15958.64	15947.50	15947.48	15947.48	159474.82	191369.78	444627.08
DEAD ROOTS 100-200 CM	11489.66	11486.90	11486.88	11486.88	114868.82	137842.59	320257.08
DUMMY MICROBES(N)	1000.00	1000.00	10000.00	10000.00	10000.00	30000.00	62800.00
DUMMY MICROBES(D)	1100044.46	1099981.14	1100004.23	1100013.66	1100268.63	3300286.52	8888653.73
TOTAL	1209433.46	1210994.80	1219940.04	1219929.12	2209138.36	4649007.53	12013875.99

SOIL VARIABLES

	NITROGEN	SALTS	PROTEIN C	RESERVE C	STRUCTURAL C	TOTAL C	ORG.O.M.
ORGANIC MATTER CONSTITUENTS							
FROM 0. TO 150. MM.	9988.27	10001.83	9969.70	9963.51	99548.43	119481.64	308724.51
FROM 150. TO 450. MM.	9999.26	9989.01	9977.41	9981.93	99882.48	119841.81	309615.39
FROM 450. TO 1000. MM.	10001.88	9982.77	9974.07	9982.67	99947.13	119903.87	309770.25
FROM1000. TO 2000. MM.	10001.87	9994.50	9991.88	9994.58	99983.57	119970.03	309929.66
TOTAL	39991.28	39968.21	39913.06	39922.68	399361.61	479197.35	1238039.82
IN MINERAL FRACTION							
FROM 0. TO 150. MM.	9929.72	9610.32					
FROM 150. TO 450. MM.	9999.58	9927.85					
FROM 450. TO 1000. MM.	9999.59	9959.09					
FROM1000. TO 2000. MM.	9999.91	9979.06					
TOTAL	39928.81	39476.33					
TOTAL, SOIL AND DEAD ORGANIC MATERIAL	1289353.55	1290439.34	1259919.25	1259934.93	2608499.98	5128204.88	13251915.81
TOTAL IN ECOSYSTEM	1289353.55	1290439.34	1259919.25	1259934.93	2608499.98	5128204.88	13251915.81

ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM

	WATER	MINERAL SOIL	NITROGEN	SALTS	TOTAL C
TO OR FROM ATMOSPHERE	277200000.00	0.00	-1634.96	0.00	0.00
BY RUN-OFF OR RUN-ON	-99172363.78	0.00	0.00	0.00	0.00
TO OR FROM SUBSOIL	0.00	0.00	0.00	0.00	0.00
TOTAL	178027636.22	0.00	-1634.96	0.00	0.00

SOIL WATER POTENTIAL, ATM.

FROM 0. TO 150. MM.	-243.02
FROM 150. TO 450. MM.	-0.59
FROM 450. TO 1000. MM.	-0.46
FROM1000. TO 2000. MM.	-0.43

ACCUMULATED PRECIPITATION = 30.0 MM. - THAT IS, 300.0 TONS PER HECTARE 0.167 SECONDS ELAPSED

DEPTH	WATER	POTENTIAL	ROOT EXT.	SALT CONC	AMT SALT	TEMP AT MID-HORIZ
0.0	0.0100	-.5000E+06	0.	0.00	0.00	13.63
15.0	0.2647	-.7868E+03	0.	32.00	8.47	14.06
45.0	0.3237	-.4479E+03	0.	47.21	15.28	15.06
100.0	0.3111	-.4968E+03	0.	171.69	53.40	17.65
200.0	0.3344	-.3968E+03	0.	0.00	0.00	

DAY	CUM. HOURS	ET	EOR	CUM.TRANS.	RUNOFF	HROOT	CWF	CUMS
136	.2400E+02	-.2039E-01	-.2039E-01	0.	0.	-.1000E+04	-.1180E+01	-.7353E-01

```
 1  .7087E-01  .3302E+00  .5652E+00  .2357E+00  .1220E-02  .2467E-01  .4689E-01  .8261E-01  0.          0.
 2  .4936E-01  .4091E-01  .5113E+00  .3559E-03  .1274E-03  .1179E-01  .1046E+00  .3882E+00  .7942E-09  0.
 3  .6199E-01  .5106E-01  .8294E+00  .2719E-04  .1998E-04  .1525E-01  .7460E-02  .4481E-01  .1060E-10  0.
 4  .4456E-01  0.         0.         0.         0.         0.         .5186E-02  .7137E-02  0.          0.
  .206E+04   .216E+03   .253E+01   .973E+00   .184E+02   .193E+02   .193E+02   .188E+02   0.          0.
  0.
SMIN     0.0000  1002.8964   51.9242  349.7985
SMIN     0.0000     0.7565    2.7080   83.5170
SMIN     0.0000     0.0349    0.2567   65.3064
SMIN     0.0000     0.0471   11.2646   24.6008
STATE( 1698) PERMITS ONLY 0.8578824342 OF THE PROPOSED UNIT CHANGE AT 145 + 0.000 DAYS
STATE( 1699) PERMITS ONLY 0.8315499022 OF THE PROPOSED UNIT CHANGE AT 148 + 0.000 DAYS
```

INPUT - OUTPUT EXAMPLE SOILS 4

REPORT NO. 4 ON MAY 31 1955 (I.E., AFTER 60 DAYS OF SIMULATION) 9.400 SECONDS ELAPSED

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

TYPE OF MATERIAL	NITROGEN	SALTS	PROTEIN C	RESERVE C	STRUCTURAL C	TOTAL C	DRY MATTER
DEAD ROOTS	18.14	18.02	18.02	18.02	180.22	216.27	502.58
GRASS DEAD	9138.58	9417.56	9417.56	9417.45	94173.00	113008.01	262276.64
BROADLEAF HERB. DEAD	8102.69	8350.58	8350.35	8350.24	83500.88	100201.47	232554.33
BROADLEAF WOODY DEAD	8102.69	8350.58	8350.35	8350.24	83500.88	100201.47	232554.33
EPHEDRA STANDING DEAD	8102.73	8350.61	8350.50	8350.40	83502.48	100203.38	232558.52
HERBACEOUS SURFACE LITTE	8098.26	8347.78	8338.06	8338.06	83380.57	100056.68	232234.95
WOODY SURFACE LITTER	13457.15	13870.55	13829.88	13829.86	138298.25	165957.98	385243.72
DEAD ROOTS 0-15CM	13211.34	13287.56	13245.72	13245.71	132456.94	158948.37	369297.54
DEAD ROOTS 15-45CM	12684.74	12555.37	12576.29	12544.93	125010.33	150131.55	348989.85
DEAD ROOTS 45-100 CM	16000.45	15989.14	15988.98	15988.98	159889.80	191867.75	445784.39
DEAD ROOTS 100-200 CM	11500.12	11497.29	11497.27	11497.27	114972.70	137967.24	320546.76
DUMMY MICROBES(N)	1000.00	1000.00	10000.00	10000.00	10000.00	30000.00	62800.00
DUMMY MICROBES(D)	1100045.72	1099975.08	1099996.16	1100008.61	1100260.56	3300265.34	8888606.54
TOTAL	1209462.61	1211010.13	1219959.13	1219939.77	2209126.62	4649025.53	12013950.15

SOIL VARIABLES

	NITROGEN	SALTS	PROTEIN C	RESERVE C	STRUCTURAL C	TOTAL C	ORG.D.M.
ORGANIC MATTER CONSTITUENTS							
FROM 0. TO 150. MM.	9988.69	10008.66	9979.09	9969.35	99557.12	119505.55	308782.13
FROM 150. TO 450. MM.	9999.32	9979.71	9961.44	9970.28	99826.65	119758.38	309413.53
FROM 450. TO 1000. MM.	10003.51	9967.15	9950.61	9967.02	99899.86	119817.48	309563.76
FROM1000. TO 2000. MM.	10003.02	9995.75	9993.61	9995.73	99987.02	119976.36	309946.07
TOTAL	39994.53	39951.27	39884.75	39902.38	399270.65	479057.78	1237705.49
IN MINERAL FRACTION							
FROM 0. TO 150. MM.	9925.80	9608.48					
FROM 150. TO 450. MM.	9999.34	9928.59					
FROM 450. TO 1000. MM.	9999.28	9959.08					
FROM1000. TO 2000. MM.	9999.91	9979.01					
TOTAL	39924.33	39475.16					
TOTAL, SOIL AND DEAD ORGANIC MATERIAL	1289381.47	1290436.57	1259906.94	1259928.14	2608397.27	5128083.30	13251655.64
TOTAL IN ECOSYSTEM	1289381.47	1290436.57	1259906.94	1259928.14	2608397.27	5128083.30	13251655.64

ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM

	WATER	MINERAL SOIL	NITROGEN	SALTS	TOTAL C
TO OR FROM ATMOSPHERE	277200000.00	0.00	-1603.99	0.00	0.00
BY RUN-OFF OR RUN-ON	-99172363.78	0.00	0.00	0.00	0.00
TO OR FROM SUBSOIL	0.00	0.00	0.00	0.00	0.00
TOTAL	178027636.22	0.00	-1603.99	0.00	0.00

SOIL WATER POTENTIAL, ATM.

FROM 0. TO 150. MM.	-243.16
FROM 150. TO 450. MM.	-0.75
FROM 450. TO 1000. MM.	-0.48
FROM1000. TO 2000. MM.	-0.43

ACCUMULATED PRECIPITATION = 30.0 MM. - THAT IS, 300.0 TONS PER HECTARE 0.150 SECONDS ELAPSED

DEPTH	WATER	POTENTIAL	ROOT EXT.	SALT CONC	AMT SALT	TEMP AT MID-HORIZ
0.0	0.0100	-.5000E+06	0.	0.00	0.00	13.69
15.0	0.2345	-.1083E+04	0.	39.45	9.25	14.28
45.0	0.3137	-.4890E+03	0.	46.74	14.67	15.42

```
  100.0    0.3122     -.4934E+03   0.                  171.47     53.53              17.78
  200.0    0.3355     -.3934E+03   0.                    0.00      0.00
 DAY   CUM. HOURS  ET            EOR          CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
 151   .2400E+02  -.2098E-01   -.2098E-01   0.            0.          -.1000E+04   -.2197E+01   -.6344E-01


 1   .6851E-01   .3299E+00   .5652E+00   .2353E+00   .1209E-02   .2475E-01   .4532E-01   .7984E-01  0.           0.
 2   .7060E-01   .7098E-01   .8880E+00   .1034E-03   .3808E-04   .2115E-01   .1990E-01   .7239E-01  .6522E-09   0.
 3   .1598E+00   .9601E-01   .1567E+01  0.           .1254E-05   .2880E-01  0.           .3712E-02  .1096E-10   0.
 4   .1544E+00  0.          0.          0.          0.          0.          0.           .6896E-02  0.           0.
   .196E+04    .221E+03    .267E+01    .925E+00    .178E+02    .186E+02    .186E+02    .182E+02   0.           0.
  0.
SMIN     0.0000     999.9459     51.3785     350.6480
SMIN     0.0000       0.1265      0.4660      86.2868
SMIN     0.0000       0.0000      0.0085      65.2780
SMIN     0.0000       0.0000     11.2065      24.7062
STATE( 1603) PERMITS ONLY 0.6716591511 OF THE PROPOSED UNIT CHANGE AT 155 + 0.000 DAYS


     INPUT - OUTPUT EXAMPLE      SOILS 4

REPORT NO.  5 ON JUNE 15 1955 (I.E., AFTER  75 DAYS OF SIMULATION)                              8.783 SECONDS ELAPSED

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE
    TYPE OF MATERIAL          NITROGEN    SALTS       PROTEIN C   RESERVE C   STRUCTURAL C  TOTAL C     DRY MATTER
DEAD ROOTS                       3.74         3.72        3.72        3.72        37.20        44.64       103.73
GRASS DEAD                    9002.46      9277.33     9277.36     9277.22     92770.31    111324.89    258370.32
BROADLEAF HERB. DEAD          7745.64      7982.66     7982.46     7982.33     79821.44     95786.23    222307.13
BROADLEAF WOODY DEAD          6968.94      7182.20     7182.01     7181.89     71817.28     86181.19    200015.10
EPHEDRA STANDING DEAD         7745.68      7982.69     7982.60     7982.48     79822.97     95788.05    222311.12
HERBACEOUS SURFACE LITTE      6964.57      7179.50     7170.26     7170.26     71702.57     86043.08    199710.31
WOODY SURFACE LITTER         14306.77     14746.51    14704.89    14704.85    147048.03    176457.77    409613.83
DEAD ROOTS 0-15CM            15477.57     15623.77    15579.52    15579.50    155794.60    186953.63    434297.96
DEAD ROOTS 15-45CM           12743.96     12607.34    12650.16    12594.25    125159.85    150404.27    349662.59
DEAD ROOTS 45-100 CM         16009.07     15997.71    15997.50    15997.50    159974.97    191969.96    446022.00
DEAD ROOTS 100-200 CM        11502.28     11499.44    11499.42    11499.42    114994.15    137992.98    320606.58
DUMMY MICROBES(N)             1000.00      1000.00    10000.00    10000.00     10000.00     30000.00     62800.00
DUMMY MICROBES(D)          1100046.92   1099969.33  1099988.49  1100003.82   1100252.90   3300245.21   8888561.70
       TOTAL               1209517.59   1211052.19  1220018.38  1219977.23   2209196.28   4649191.88  12014382.37

SOIL VARIABLES
                              NITROGEN     SALTS       PROTEIN C   RESERVE C    STRUCTURAL CTOTAL C      ORG.D.M.
ORGANIC MATTER CONSTITUENTS
  FROM   0. TO  150. MM.      9989.10     10015.17     9988.03     9974.91     99565.42    119528.36    308837.13
  FROM 150. TO  450. MM.      9999.83      9959.43     9929.02     9947.68     99737.95    119614.64    309066.86
  FROM 450. TO 1000. MM.     10007.06      9935.27     9902.76     9935.10     99803.74    119641.60    309143.58
  FROM1000. TO 2000. MM.     10005.06      9997.80     9996.68     9997.78     99993.15    119987.61    309975.21
       TOTAL                 40001.05     39907.67    39816.49    39855.46    399100.27    478772.22   1237022.78
IN MINERAL FRACTION
  FROM   0. TO  150. MM.      9921.89      9606.54
  FROM 150. TO  450. MM.      9998.83      9929.89
  FROM 450. TO 1000. MM.      9998.64      9959.11
  FROM1000. TO 2000. MM.      9999.91      9979.01
       TOTAL                 39919.27     39474.55

TOTAL, SOIL AND DEAD
    ORGANIC MATERIAL       1289437.92   1290434.41  1259896.90  1259918.88   2608296.54   5127964.10  13251405.15

TOTAL IN ECOSYSTEM         1289437.92   1290434.41  1259896.90  1259918.88   2608296.54   5127964.10  13251405.15



ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM
                                  WATER        MINERAL SOIL   NITROGEN     SALTS         TOTAL C
 TO OR FROM ATMOSPHERE        277200000.00            0.00    -1544.55      0.00          0.00
 BY RUN-OFF OR RUN-ON         -99172363.78            0.00        0.00      0.00          0.00
 TO OR FROM SUBSOIL                   0.00            0.00        0.00      0.00          0.00

      TOTAL                   178027636.22            0.00    -1544.55      0.00          0.00

SOIL WATER POTENTIAL, ATM.
  FROM   0. TO  150. MM.        -243.44
  FROM 150. TO  450. MM.          -1.06
  FROM 450. TO 1000. MM.          -0.50
  FROM1000. TO 2000. MM.          -0.43

ACCUMULATED PRECIPITATION =    30.0 MM. - THAT IS,         300.0 TONS PER HECTARE                0.167 SECONDS ELAPSED
   DEPTH       WATER        POTENTIAL    ROOT EXT.    SALT CONC    AMT SALT    TEMP AT MID-HORIZ
     0.0     0.0100     -.5000E+06   0.                 0.00        0.00          17.89
    15.0     0.2107     -.1679E+04   0.                47.40        9.99          17.61
    45.0     0.3047     -.5423E+03   0.                46.63       14.21          17.37
   100.0     0.3127     -.4919E+03   0.               171.34       53.58          18.28
   200.0     0.3360     -.3919E+03   0.                 0.00        0.00
 DAY   CUM. HOURS  ET            EOR          CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
 166   .2400E+02  -.2431E-01   -.2431E-01   0.            0.          -.1000E+04   -.3076E+01   -.5470E-01


 1   .6635E-01   .3296E+00   .5652E+00   .2349E+00   .1198E-02   .2484E-01   .4390E-01   .7731E-01  0.           0.
 2   .1132E+00   .1593E+00   .2001E+01   .9472E-04   .1482E-04   .4772E-01   .1057E-01   .1695E-01  .5809E-09   0.
 3   .2718E+00   .2011E+00   .3311E+01  0.          0.           .6033E-01  0.          0.          .1233E-10   0.
 4   .1192E+00  0.          0.          0.          0.          0.          0.           .6674E-02  0.           0.
   .187E+04    .226E+03    .283E+01    .881E+00    .173E+02    .180E+02    .180E+02    .176E+02   0.           0.
  0.
SMIN     0.0000     996.9618     50.8508     351.4550
SMIN     0.0000       0.0514      0.0805      86.3804
SMIN     0.0000       0.0000      0.0000      64.6498
SMIN     0.0000       0.0000     11.1047      24.8080


     INPUT - OUTPUT EXAMPLE      SOILS 4

REPORT NO.  6 ON JULY 10 1955 (I.E., AFTER 100 DAYS OF SIMULATION)                             14.000 SECONDS ELAPSED

CONSTITUENTS OF DEAD ORGANIC MATERIAL, G. OR KCAL. PER HECTARE
    TYPE OF MATERIAL          NITROGEN    SALTS       PROTEIN C   RESERVE C   STRUCTURAL C  TOTAL C     DRY MATTER
DEAD ROOTS                       0.27         0.27        0.27        0.27         2.67         3.20         7.45
GRASS DEAD                    8780.07      9048.24     9048.29     9048.12     90478.75    108575.16    251988.55
BROADLEAF HERB. DEAD          7185.15      7405.11     7404.95     7404.78     74045.56     88855.29    206221.32
BROADLEAF WOODY DEAD          5420.58      5586.54     5586.42     5586.29     55861.09     67033.80    155576.55
EPHEDRA STANDING DEAD         7185.18      7405.14     7405.08     7404.92     74046.97     88856.97    206225.01
HERBACEOUS SURFACE LITTE      5416.36      5584.01     5575.51     5575.51     55755.08     66906.10    155294.52
WOODY SURFACE LITTER         15649.18     16130.55    16087.44    16087.37    160872.89    193047.70    448119.21
DEAD ROOTS 0-15CM            18572.25     18814.19    18766.21    18766.15    187660.71    225193.08    523052.77
DEAD ROOTS 15-45CM           12984.24     12838.88    12994.47    12822.85    125825.86    151643.19    352681.01
DEAD ROOTS 45-100 CM         16011.13     15999.75    15999.44    15999.44    159994.44    191993.33    446076.49
DEAD ROOTS 100-200 CM        11502.80     11499.95    11499.93    11499.93    114999.32    137999.19    320621.00
DUMMY MICROBES(N)             1000.00      1000.00    10000.00    10000.00     10000.00     30000.00     62800.00
DUMMY MICROBES(D)          1100048.80   1099960.30  1099976.46  1099996.30   1100240.88   3300213.64   8888491.35
       TOTAL               1209756.00   1211272.93  1220344.47  1220191.95   2209784.23   4650320.65  12017155.23

SOIL VARIABLES
                              NITROGEN     SALTS       PROTEIN C   RESERVE C    STRUCTURAL CTOTAL C      ORG.D.M.
ORGANIC MATTER CONSTITUENTS
  FROM   0. TO  150. MM.      9989.77     10025.41    10002.11     9983.67     99578.54    119564.32    308923.87
  FROM 150. TO  450. MM.     10003.44      9870.78     9793.85     9856.47     99441.24    119091.56    307809.26
  FROM 450. TO 1000. MM.     10016.06      9788.72     9682.87     9788.47     99363.17    118834.51    307208.19
  FROM1000. TO 2000. MM.     10007.56     10000.30    10000.43    10000.28    100000.65    120001.36    310010.83
       TOTAL                 40016.83     39685.22    39479.26    39628.89    398383.60    477491.75   1233952.15
IN MINERAL FRACTION
```

FROM 0. TO 150. MM.	9915.37	9603.15
FROM 150. TO 450. MM.	9996.66	9931.39
FROM 450. TO 1000. MM.	9995.92	9959.16
FROM1000. TO 2000. MM.	9999.91	9979.01
TOTAL	39907.87	39472.71

TOTAL, SOIL AND DEAD ORGANIC MATERIAL	1289680.69	1290430.86	1259884.71	1259905.28	2608167.83	5127812.40	13251107.38
TOTAL IN ECOSYSTEM	1289680.69	1290430.86	1259884.71	1259905.28	2608167.83	5127812.40	13251107.38

ACCUMULATED NET GAIN OR LOSS TO ECOSYSTEM

	WATER	MINERAL SOIL	NITROGEN	SALTS	TOTAL C
TO OR FROM ATMOSPHERE	277200000.00	0.00	-1297.84	0.00	0.00
BY RUN-OFF OR RUN-ON	-99172363.78	0.00	0.00	0.00	0.00
TO OR FROM SUBSOIL	0.00	0.00	0.00	0.00	0.00
TOTAL	178027636.22	0.00	-1297.84	0.00	0.00

SOIL WATER POTENTIAL, ATM.

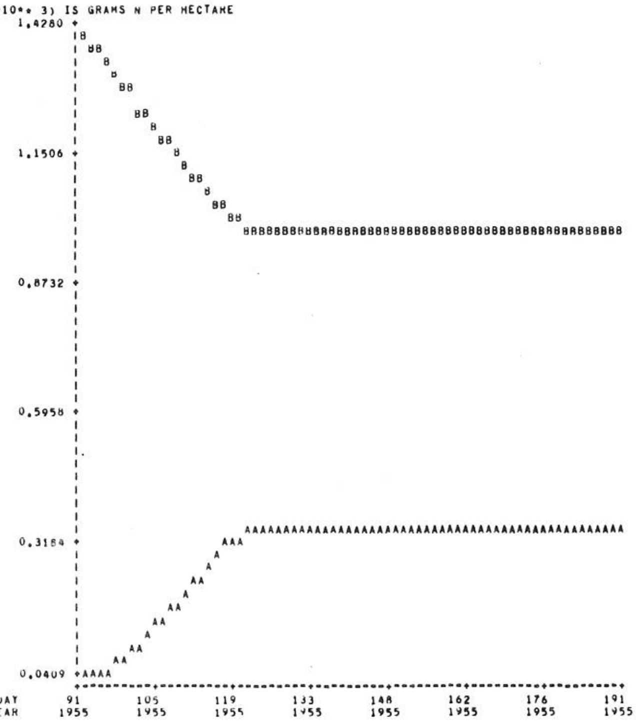
FROM 0. TO 150. MM.	-244.42
FROM 150. TO 450. MM.	-2.06
FROM 450. TO 1000. MM.	-0.53
FROM1000. TO 2000. MM.	-0.43

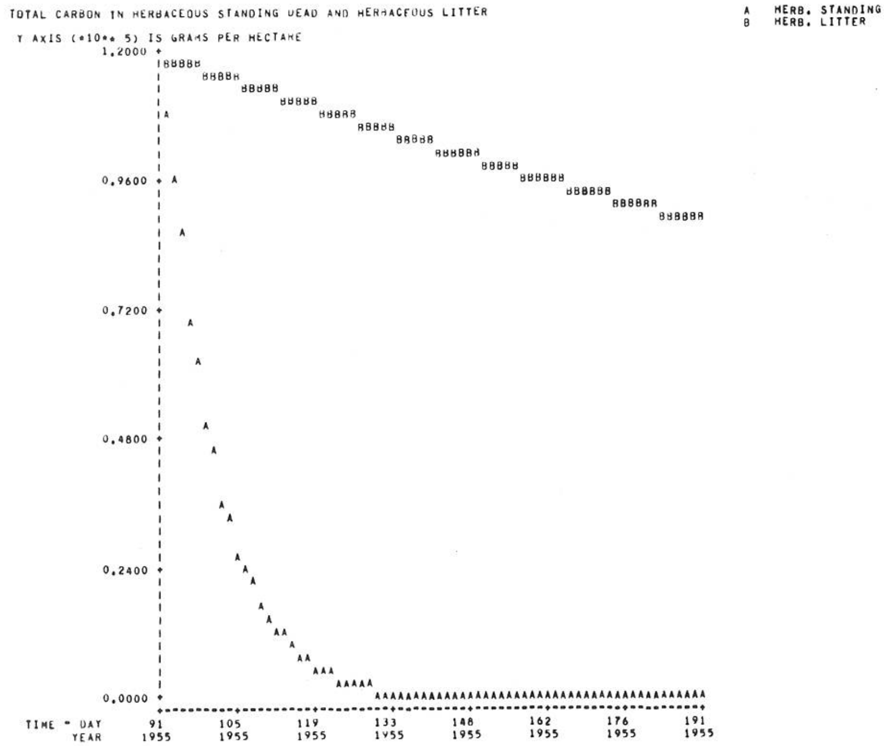
ACCUMULATED PRECIPITATION = 30.0 MM. - THAT IS, 300.0 TONS PER HECTARE

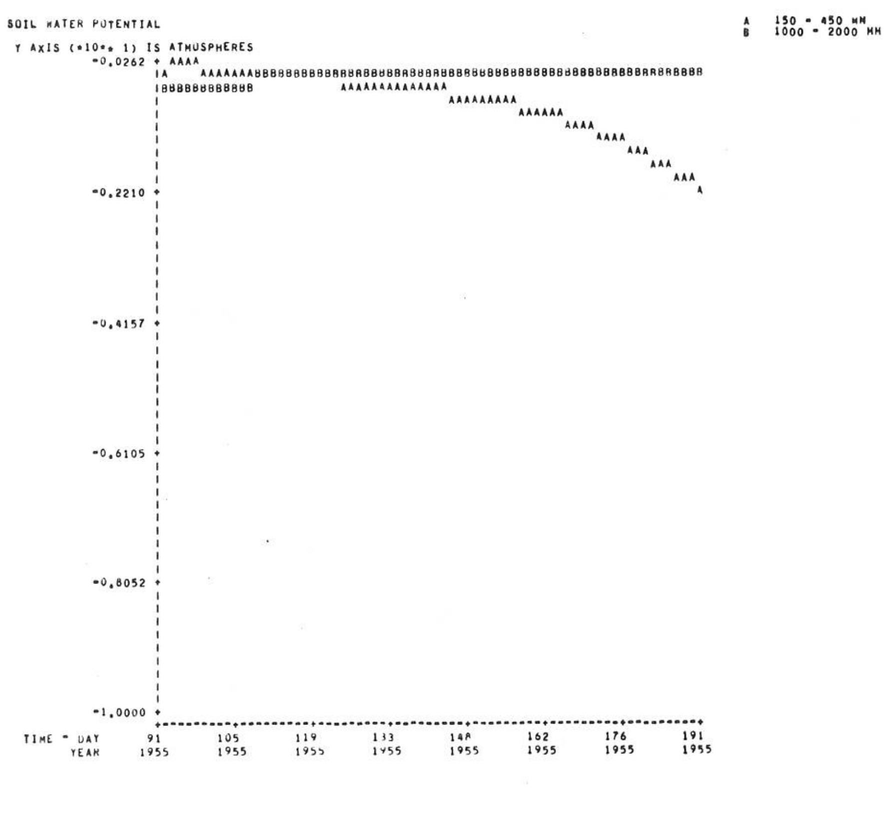
NITRATE AND AMONIUM IN TOP 15 CM OF SOIL

A NITRATE
B AMONIUM

Y AXIS (*10** 3) IS GRAMS N PER HECTARE




TOTAL CARBON IN HERBACEOUS STANDING DEAD AND HERBACEOUS LITTER
Y AXIS (*10** 5) IS GRAMS PER HECTARE
A HERB. STANDING
B HERB. LITTER
1.2000
0.9600
0.7200
0.4800
0.2400
0.0000
TIME - DAY 91 105 119 133 148 162 176 191
YEAR 1955 1955 1955 1955 1955 1955 1955 1955


SOIL WATER POTENTIAL
Y AXIS (*10** 1) IS ATMOSPHERES
A 150 - 450 MM
B 1000 - 2000 MM
-0.0262
-0.2210
-0.4157
-0.6105
-0.8052
-1.0000
TIME - DAY 91 105 119 133 148 162 176 191
YEAR 1955 1955 1955 1955 1955 1955 1955 1955

APPENDIX 2

Program Listings

Subroutine DECOMP

```
$SET SEPARATE
$RESET FREE
$SET STACK
$SET OWN
      SUBROUTINE DECOMP
C     WRITTEN BY HANNA PARNAS AND JOHN RADFORD
C     THIS PROGRAM IS PART OF DESERT BIOME MODEL SOILS IV
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975      PAUL W. LOMMEN

      DIMENSION RCHECK(20)
      DIMENSION GC(12),KMC(10),KMR(10),BNFAC(4),E2CPCT(6),CFEPCT(11,6)
      DIMENSION TC(4),PHC(4),SAC(4),WC(4),TCE(4),PHCE(4),WCE(4)
      COMMON/ACCINC/ AGAINQ(3,4),DUMAC(6)
      COMMON/SPEC/ NCHAN,INSTRU(20),  NSPECV,NSPECA,NORGAN,NFRACT,
     1 NDAY,NELEM,NOLIT,NCHECK,IDAY,IYRDAY,NREPET(20),NDEBUG,NHORIZ,
     2 NCOM(10),LISCOM(30),NCOMCU(10),NCOMOR,NFRELM,NFRAC1,NSPCOM,MONTH,
     3 HORDEP(6),LITDEP(5),MREP(20),IYR,DRYFAV(3,6),LITCAT(15)
     4,NVECOM,LISVCO(15),NVCOM(10),NVCOCU(10),NOSECS,IRUN,NDEPLT
     5,ISTD,JSTD,ILIT,JLIT,ILM,JLM,SEEDEP(6),NSEEDM ,NELEMS,JSTATE,JDAY
      COMMON/TOTALS/TDUM1(190),CLITT(15),TDUM2(212),ALIT(15),AORG(5),
     1  TDUM3(1022)
      COMMON/STAT/ SDUM1(1470),CLIT(15,6),CORG(5,6),CMIN(5,6),
     1 SDUM2(70),SMIN(5,4),DUMBIO(11,6),CO2(15),DUMMY(149)
      COMMON/CHANGE/CDUM1(1470),CLITQQ(15,6),CORGQQ(5,6),CMINQQ(5,6),
     1 CDUM2(70),SMINQQ(5,4),DUMBIQ(11,6),CO2QQQ(15),DUMMYQ(149)
      COMMON/SOIDEC/ EXTDEC,CBIO(11) ,NZONES
      COMMON/SOIENV/TEMP(7), PH(7), SS(7), WATPOT(7), TNC(6)

      LOGICAL INSOIL,SUM,EXTDEC,WRTBIO
      REAL KMN,KMC,KMR,MAINC,KMC

      DATA WRTBIO/.FALSE./

C-----------------------------------------------------------------------
C-........NAMELIST OF PARAMETERS
C-........FOR EXPLANATIONS OF PARAMETER MEANINGS, SEE THE DESERT BIOME
C-........WRITE-UP(SEPARATE PUBLICATION FOR 1973) WHEREIN PARAMETERS
C-........ARE LISTED
      IX=0
      IL=ILM
C-----------------------------------------------------------------------
C-........DECOMPOSITION FOR EACH ENVIRONMENTAL ZONE IN SOIL AND ABOVE
      DO 2000 I=1,NZONES
      D=D1
      TGR=0.0
      INSOIL=.TRUE.
      IF (I.GT.NHORIZ) INSOIL=.FALSE.
C-........DETERMINE ENVIRONMENTAL COEFFICIENTS FOR PRESENT ZONE
      CALL OPT(TC(1),TC(2),TC(3),TC(4),TEMP(I),TCC)
      CALL OPT(PHC(1),PHC(2),PHC(3),PHC(4),PH(I),PHCC)
      CALL OPT(SAC(1),SAC(2),SAC(3),SAC(4),SS(I),SCC)
      CALL OPT(WC(1),WC(2),WC(3),WC(4),WATPOT(I),WCC)
      IF (I.GT. ISURF.OR..NOT.EXTDEC) GO TO 15
C-........ENVIRONMENTAL COEFFICIENTS FOR ENZYMES INVOLVED IN EXTERNAL
C-........BREAKDOWN OF LITTER AND DEAD ROOTS
      CALL OPT(TCE(1),TCE(2),TCE(3),TCE(4),TEMP(I),TRC)
      CALL OPT(PHCE(1),PHCE(2),PHCE(3),PHCE(4),PH(I),PHRC)
      CALL RAMP(WCE(1),WCE(2),WATPOT(I),WRC)
C-----------------------------------------------------------------------
C-........DETERMINE THE NUMBER OF TYPES OF DEAD MATERIAL TO DECOMPOSE
C-........IN THE PRESENT ZONE.
   15 IR=0
      NR=NR1
      IF (INSOIL) GO TO 1000
      IF (I.NE.ISURF) GO TO 18
C-........EXECUTION COMES TO THIS POINT IF SURFACE LITTER IS DEALT WITH
C-........AS A PART OF THE TOP SOIL HORIZON ZONE
   16 IR=ILIT-1
      NR=JLIT
      GO TO 1000
   18 IR=ISTD-1
      NR=JSTD
C-----------------------------------------------------------------------
 1000 IR=IR+1
      VR=0.0
      DMINR=0.0
      DIMMO=0.0
      SOM=.FALSE.
      L=IL
C-........FIND VALUES FOR TOTAL CARBON, TOTAL NITROGEN AND PROTEIN CAR-
C-........BON FOR THE APPROPRIATE TYPE OF DEAD MATERIAL OR SOIL ORGANIC
C-........MATTER
      IF((.NOT.INSOIL).OR.IR.NE.ISOM) GO TO 20
      SOM=.TRUE.
      RCARB=AORG(I)
      RNIT=CORG(I,INIT)
      PROTC=CORG(I,IPC)
      GO TO 30
   20 IF (.NOT.INSOIL) L=IR
      RCARB=ALIT(L)
      RNIT=CLIT(L,INIT)
      PROTC=CLIT(L,IPC)
   30 CONTINUE
      IF (RCARB.LE.0.0) GO TO 300
C-........CARBON/NITROGEN RATIO
      CN=0.0
      IF (RNIT.GT.0.0) CN=RCARB/RNIT
C-----------------------------------------------------------------------
C-........K IS THE BIOMASS NUMBER WITH WHICH ONE DECOMPOSES THE PRESENT
C-........DEAD MATERIAL BEING WORKED ON.  J DETERMINES THE GROWTH RATE
C-........OF BIOMASS K IN PART AND DEPENDS ON TYPE OF DEAD MATERIAL
      K=1
      IF (I.GT.ISURF) K=ISURF+IR-ISTD+1
      IF (INSOIL) J=IR
      IF (.NOT.INSOIL) J=J+1
C-........AVAILABLE NITROGEN POOL
      IF (I.LE.ISURF) RNITNC=RNIT+TNC(K)
      IF (I.GT.ISURF) RNITNC=RNIT
      GRC= GC(J)*TCC*PHCC*SCC*WCC
C-........GRDEC IS GROWTH RATE OF K ON PRESENT DEAD MATERIAL TYPE
      GRDEC=GRC*RCARB*RNITNC/((KMC+RCARB)*(KMN+RNITNC))
      TGR=TGR+GRDEC
C-........TOTAL CARBON DECOMPOSITION
      DORGC=(GRDEC/EFC+MAINC)*CBIO(K)
      DCO2=(1.-EFC)*DORGC
      CO2QQQ(L)=CO2QQQ(L)+DCO2
C-........PROTEIN CARBON DECOMPOSITION
      IF (CN.GE.BC2BNE) GO TO 103
      DPROTC=DORGC*PROTC/RCARB
      GO TO 105
  103 DPROTC=PC2PN*BN*GRDEC*CBIO(K)*RNIT/RNITNC
C-........OTHER CARBON DECOMPOSITION
  105 DOTHRC=DORGC-DPROTC
C-........PROTEIN NITROGEN DECOMPOSITION
      DORGN=DPROTC/PC2PN
C-........MINERALIZATION/IMMOBILIZATION
      DMINR=DORGN-BN*GRDEC*CBIO(K)*RNIT/RNITNC
      DIMMO=BN*GRDEC*CBIO(K)*(RNITNC-RNIT)/RNITNC
C-........EXTERNAL BREAKDOWN
      IF (SUM.OR.I.GT.ISURF.OR.(.NOT.EXTDEC)) GO TO 110
      IX=IX+1
      KEX=KMC(IX)*TRC*PHRC*WRC
      VR=KEX*BE*CBIO(K)*RCARB/(KMR(IX)+RCARB)
  110 CONTINUE
C-----------------------------------------------------------------------
C-........CHANGES IN CONCENTRATIONS OF DEAD MATERIAL CONSTITUENTS
      II=I
      IF (.NOT.INSOIL) II=1
      DO 200 M=1,NFRELM
      IF ((SOM.AND.CORG(II,M).LE.0.).OR.(.NOT.SOM.AND.CLIT(L,M).LE.0.))
     *              GO TO 200
      DLOS=0.0
      EXTLOS=0.0
      IF (.NOT.SOM) EXTLOS=(CLIT(L,M) /CLITT(M))*VR
      IF (M.EQ.INIT) DLOS=DLOS+DORGN
      DMINRL=0.0
C-........CFEPCT DETERMINES THE REQUIREMENT OF BIOMASS K FOR CONSTITUENT
C-........M RELATIVE TO TOTAL CARBON DECOMPOSITION. E2CPCT IS LIKE AN
C-........INEFFICIENCY OF UTILIZATION OF CONSTITUENT M--UNITS M MINERAL-
C-........IZED PER UNIT M ASSIMILATED
      IF (M.NE.INIT.AND.M.LT.NFRAC1) DMINRL=E2CPCT(M)*CFEPCT(K,M)*DORGC
      IF (M.EQ.IPC) DLOS=DLOS+DPROTC
      IF (M.EQ.IPC.OR.M.LT.NFRAC1) GO TO 140
      IF (SUM) DLOS=DLOS+(CORG(II,M)/(AORG(I)-PROTC))*DOTHRC
      IF (.NOT.SOM) DLOS=DLOS+(CLIT(L,M) /(ALIT(L)-PROTC))*DOTHRC
C-........ADD AND SUBTRACT CHANGES
  140 IF (SUM) CORGQQ(I,M)=CORGQQ(I,M)-DLOS-DMINRL
      IF (.NOT.SOM) CLITQQ(L,M)=CLITQQ(L,M)-DLOS-EXTLOS-DMINRL
      CORGQQ(II,M)=CORGQQ(II,M)+EXTLOS
      CMINQQ(II,M)=CMINQQ(II,M)+DMINRL
C-........RESPIRATION
      R=0.0
      IF (M.GE.NFRAC1) R=DCO2*(DLOS/DORGC)
C-........DUMBIQ IS A STATE VARIABLE EQUIVALENT TO CBIO
      DUMBIQ(K,M)=DUMBIQ(K,M)+DLOS-R
      AGAINQ(KA,ICO2)=AGAINQ(KA,ICO2)-R
  145 IF (M.NE.INIT) GO TO 200
      IF (DIMMO.LE.0.0.OR.I.GT.ISURF) GO TO 160
      DO 150 N=2,NNIT
      IF (SMIN(II,N) .LE.0.0) GO TO 150
      DIM=DIMMO*BNFAC(N)*SMIN(II,N)/TNC(K)
      SMINQQ(II,N) =SMINQQ(II,N) -DIM
      DUMBIQ(K,M)=DUMBIQ(K,M)+DIM
  150 CONTINUE
  160 IF (SOM) CORGQQ(II,M)=CORGQQ(II,M)-DMINR
      IF (.NOT.SOM) CLITQQ(L,M)=CLITQQ(L,M)-DMINR
      SMINQQ(II,INH4)=SMINQQ(II,INH4)+DMINR
  200 CONTINUE
C-........DEATH RATE OF DECOMPOSERS
      IF (RCARB.GT.0.0) D=D2
  300 IF (I.LE.ISURF) GO TO 1500
C-........BIOMASS OF DECOMPOSERS IN STANDING DEAD
      VD=CBIO(K)*(1.-1./EXP(D))
      DO 1400 M=1,NFRELM
      IF (DUMBIO(K,M).LE.0.0) GO TO 1400
      DUMBIQ(K,M)=DUMBIQ(K,M)-CFEPCT(K,M)*VD
      CLITQQ(L,M)=CLITQQ(L,M)+CFEPCT(K,M)*VD
 1400 CONTINUE
      CBIO(K)=CBIO(K)*EXP(GRDEC-D)
      D=D1
C-........IF THERE ARE ANY MORE TYPES OF DEAD MATERIAL AVAILABLE FOR
C-........THIS ZONE, GO GET THE NEXT TYPE. ELSE, GO TO NEXT ZONE
 1500 IF (IR.LT.NR) GO TO 1000
C-----------------------------------------------------------------------
      IF (I.GT.ISURF) GO TO 2000
      IF (INSOIL.AND.ISURF.EQ.NHORIZ.AND.I.EQ.1) GO TO 1600
C-........BIOMASS OF SURFACE AND/OR SOIL DECOMPOSER POPULATIONS
      VD=CBIO(K)*(1.-1./EXP(D))
      DO 1550 M=1,NFRELM
      IF (DUMBIO(K,M).LE.0.0) GO TO 1550
      DUMBIQ(K,M)=DUMBIQ(K,M)-CFEPCT(K,M)*VD
      CORGQQ(II,M)=CORGQQ(II,M)+CFEPCT(K,M)*VD
 1550 CONTINUE
      CBIO(K)=CBIO(K)*EXP(TGR-D)
 1600 IF (.NOT.INSOIL) GO TO 2000
C-........DO THIS WHEN SURFACE LITTER IS BEING DECOMPOSED BY HORIZON 1
C-........POPULATION
      IL=IL+1
      IF (ISURF.NE.NHORIZ.OR.I.NE.1) GO TO 2000
      INSOIL=.FALSE.
      GO TO 16
 2000 CONTINUE
C-----------------------------------------------------------------------
C..........IF NDEBUG SWITCH IS OFF, THEN WRITE ONLY WHEN REPORTS ARE
C..........CALLED FOR
      IF(WRTBIO)GOTO210
      IF((NDEBUG.GT.0).OR.(IDAY.EQ.JDAY))GOTO210
      DO205JJJ=1,20
      IF(MREP(JJJ).LE.0)GOTO220
      IF(IDAY.EQ.MREP(JJJ))GOTO210
  205 CONTINUE
      GOTO220
  210 WRITE(6,211)CBIO
      WRITE(6,805)((SMIN(I,J ),J=1,4),I=1,NHORIZ)
  211 FORMAT(2H  ,11E11.3)
  805 FORMAT(' SMIN',4F12.4)
  220 CONTINUE
      RETURN
C-----------------------------------------------------------------------
      ENTRY SNIN
C-........NAMELIST INPUT/WRITE-OUT
C-........NAMELIST PARNAS REPLACED BY FORMATTED INPUT 1-74 PAUL LOMMEN
      READ(5,801)RCHECK
      WRITE(6,802)  RCHECK
      READ(5,90) BC2BNE,BE,BN, BNFAC, CBIO,((CFEPCT(JI,JK),JK=1,6),
     1 JI=1,11) ,D1,D2, ((DUMBIO(JI,JK),JK=1,6),JI=1,11), EFC, E2CPCT
      READ(5,801)RCHECK
      WRITE(6,802)  RCHECK
      READ(5,91) GC,IAGN,ICO2,INH4,INIT,IPC,ISOM,ISURF,KA
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,92) KMC,KMC,KMN,KMR,MAINC,NNAMLS,NNIT,NR1,PC2PN
      READ(5,801)  RCHECK
      WRITE(6,802)RCHECK
      READ(5,93) PHC,PHCE,SAC,TC,TCE,WC,WCE,WRTBIO
      READ(5,801)  RCHECK
```

```
      WRITE(6,802)RCHECK
   90 FORMAT(3E11.3/,4F10.5/,6E11.3/,5E11.3/, 11(6F10.5/),
     1 2F10.5/, 11(6E11.3/), F10.5/, 6F10.5)
   91 FORMAT(2(6F10.5/), 8I5)
   92 FORMAT(2(5F10.0/),2F10.0/,2(5F10.0/),F10.0/,3I5/,F10.0)
   93 FORMAT( 2(4F10.5/), 4F10.0/, 2(4F10.5/),2(4F10.0      /),L4)
  801 FORMAT (20A4)
  802 FORMAT (' ',5X,20A4)
      RETURN
      END
```

Subroutine NITRO

```
 $SET SEPARATE
 $RESET FREE
 $SET STACK
 $SET OWN
      SUBROUTINE NITRO
C     WRITTEN BY HANNA PARNAS AND JOHN HADFORD
C     THIS PROGRAM IS PART OF DESERT BIOME MODEL SOILS IV
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975      PAUL W. LOMMEN
      DIMENSION RCHECK(20)
      DIMENSION T(5,4),PHK(5,4),SA(5,4),W(5,4),G(5),GM(5),GR(5),CM(7),
     1 BIOM(4,5),V(5),D(5),D1(5),D2(5),CFEPCT(4,6)
      COMMON/ACCINC/ AGAINQ(3,4),DUMAC(6)
      COMMON/SPEC/ NCHAN,INSTRU(20),  NSPECV,NSPECA,NORGAN,NFRACT,
     1 NDAY,NELEM,NOLIT,NCHECK,IDAY,IYRDAY,NREPET(20),NDEBUG,NHORIZ,
     2 NCOH(10),LISCOH(30),NCOHCU(10),NCOHOR,NFRELM,NFRAC1,NSPCOH,MONTH,
     3 HORDEP(6),LITDEP(5),MREP(20),IYR,DRYFAV(3,6),LITCAT(15)
     4,NVECOH,LISVCO(15),NVCOH(10),NVCUCU(10),NOSECS,IRUN,NDEPLT
     5,ISTD,JSTD,ILIT,JLIT,ILH,JLH,SEEDEP(6),NSEEDH ,NELEMS,JSTATE,JDAY
      COMMON/TOTALS/ TDUM1(417),ALIT(15),AORG(5),TDUM2(1022)
      COMMON/STAT/ SDUM1(1470),CLIT(15,6),CORG(5,6),CMIN(5,6),
     1 SDUM2(8),TCOVER,SDUM3(61),SMIN(5,4),SD4(81),FIXN2(5),DUMMY(144)
      COMMON/CHANGE/CDUM1(1470),CLITQQ(15,6),CORGQQ(5,6),CMINQQ(5,6),
     1 CDUM2(70),SMINQQ(5,4),SD4QQQ(81),FIXN2Q(5),DUMMYQ(144)
      COMMON/SOINIT/ CI(5),AUTGRO,AUTNIT,SYMNIT(5),B1(5)
      COMMON/SOIDEC/ EXTDEC,CBIO(11)
      COMMON/SOIENV/ TEMP(7),PH(7),SS(7),WATPOT(7),TNC(6)
      LOGICAL SYMFIX,HETFIX,VOLATL,WRTNIT
      REAL K3,KM3,K4,KM4,MAIN3,MAIN4
      IL=ILH
C-------------------------------------------------------------------------
C.........NITROGEN TRANSFORMATIONS FOR EACH SOIL HORIZON
      DO 17 N=1,NHORIZ
      DO 5 I=1,IR
C.........ENVIRONMENTAL COEFFICIENTS FOR EACH TRANSFORMATION TYPE I
      CALL OPT(T(I,1),T(I,2),T(I,3),T(I,4),TEMP(N),TC)
      CALL OPT(PHK(I,1),PHK(I,2),PHK(I,3),PHK(I,4),PH(N),PHC)
      CALL OPT(SA(I,1),SA(I,2),SA(I,3),SA(I,4),SS(N),SC)
      CALL OPT(W (I,1),W (I,2),W (I,3),W (I,4),WATPOT(N),WC)
C.........GROWTH RATE FOR BIOMASS INVOLVED IN TRANSFORMATION I
      G(I)=GM(I)*TC*PHC*SC*WC
      GR(I)=0.0
      V(I)=0.0
      D(I)=D1(I)
    5 CONTINUE
C-------------------------------------------------------------------------
C.........TOTAL SOIL CARBON IN DEAD MATERIALS
      TOTOC =AORG(N)+ALIT(IL)
C.........SYMBIOTIC FIXATION
      IF (.NOT.SYMFIX) GO TO 15
      GR(1)=G(1)*CI(N)/(CM(1)+CI(N))
      IF(CI(N).GT.0.0)D(1)=D2(1)
C.........FREE HETEROTROPHIC FIXATION
   15 IF (.NOT.HETFIX) GO TO 20
      GR(2)=G(2)*TOTOC/(CM(2)+TOTOC)
      IF (TOTOC .GT.0.0) D(2)=D2(2)
      V(2)=BIOM(2,N)*(1.-1./EXP(D(2)))
C.........OXIDATION OF NH4 TO NO2
   20 GR(3)=G(3)*SMIN(N,INH4)/(CM(3)+SMIN(N,INH4))
      IF (SMIN(N,INH4).GT.0.0) D(3)=D2(3)
      V6=(A3*GR(3)+MAIN3+K3*B3*SMIN(N,INH4)/
     *        (SMIN(N,INH4)+KM3))*BIOM(3,N)
      V6TOB3=AMIN1(V6,GR(3)*BN*BIOM(3,N)/A3)
      DEATH3=BIOM(3,N)*(1.-1./EXP(D(3)))
C.........OXIDATION OF NO2 TO NO3
      GR(4)=G(4)*SMIN(N,INO2)/(CM(4)+SMIN(N,INO2))
      IF (SMIN(N,INO2).GT.0.0) D(4)=D2(4)
      V7=(A4*GR(4)+MAIN4+K4*B4*SMIN(N,INO2)/
     *        (SMIN(N,INO2)+KM4))*BIOM(4,N)
      V7TOB4=AMIN1(V7,GR(4)*BN*BIOM(4,N)/A4)
      DEATH4=BIOM(4,N)*(1.-1./EXP(D(4)))
C.........DENITRIFICATION BY PART OF DECOMPOSER BIOMASS CBIO
      GG=G(5)*(SMIN(N,INO2)+SMIN(N,INO3))*CION/((SMIN(N,INO2)+
     1 SMIN(N,INO3)+CM(5))*(CION+WATPOT(N)))
      GR(5)=GG*TOTOC/(CM(6)+TOTOC)
      IF (TOTOC .GT.0.0) D(5)=D2(5)
      V8=A5*GR(5)*CBIO(N)/CBFAC
C.........NH3 VOLATILIZATION
      IF (N.GT.1.OR.(.NOT.VOLATL)) GO TO 14
      CALL RAMP(TMIN,TMAX,TEMP(N),TC8)
      CALL RAMP(PHMIN,PHMAX,PH(N),PHC8)
      CALL DCLIN(VMAX,TCOVER,SOCOC)
      V10=SMIN(N,INH4)*TC8*PHC8*SOCOC*FVNH4
      GO TO 19
   14 V10=0.0
C.........IMMOBILIZATION OF MINERAL NITROGEN BY FIXERS
C.........V111 IS GROWTH REQUIREMENT, V11-- ARE UTILIZATIONS OF PARTI-
C.........CULAR TYPES OF N BASED ON PREFERENCES
   19 IF (N.GT.1) V111=(GR(1)*BIOM(1,N)+GR(2)*BIOM(2,N))*BN
      IF (N.LE.1) V111=(GR(1)*BIOM(1,N)+GR(2)*BIOM(2,N)+AUTGRO)*BN
      V11=V111*TNC(N)/(TNC(N)+CM(7))
C-------------------------------------------------------------------------
C.........RESULTANT CHANGES IN NITROGEN POOLS
C.........AMMONIUM
      IF (SMIN(N,INH4).LE.0.0) GO TO 30
      V11NH4=V11*BNH4*SMIN(N,INH4)/TNC(N)
      SMINQQ(N,INH4)=SMINQQ(N,INH4)-V11NH4-V6-V10
      GO TO 35
   30 V10=0.0
      V11NH4=0.0
      V6=0.0
C.........NITRITE
   35 IF (SMIN(N,INO2).LE.0.0) GO TO 40
      V11NO2=V11*BNO2*SMIN(N,INO2)/TNC(N)
   38 SMINQQ(N,INO2)=SMINQQ(N,INO2)-V11NO2+V6-V6TOB3-V7-V8*SMIN(N,INO2)
     */(SMIN(N,INO3)+SMIN(N,INO2))
      GO TO 45
   40 V7=0.0
      V11NO2=0.0
C.........NITRATE
      SMINQQ(N,IN[illegible](N,INO2)+V6-V6TOB3
   45 IF (SMIN(N,INO3).LE.0.0) GO TO 50
      V11NO3=V11*BNO3*SMIN(N,INO3)/TNC(N)
   48 SMINQQ(N,INO3)=SMINQQ(N,INO3)-V11NO3+V7-V7TOB4-V8*SMIN(N,INO3)/
     *  (SMIN(N,INO3)+SMIN(N,INO2))
      GO TO 55
   50 V11NO3=0.0
      SMINQQ(N,INO3)=SMINQQ(N,INO3)+V7-V7TOB4
   55 CONTINUE
C.........GAIN IN ORGANIC NITROGEN
      IF (N.EQ.1) AUTNIT=AUTGRO*BN
      SYMNIT(N)=GR(1)*BIOM(1,N)*BN
C.........DHUMNI IS CONTRIBUTION OF N TO SOIL ORGANIC MATTER VIA DEATH
      DHUMNI=(V(2)+DEATH3+DEATH4)*BN
      CORGQQ(N,INIT)=CORGQQ(N,INIT)+DHUMNI
C-------------------------------------------------------------------------
C.........CHANGES IN BIOMASSES AND IN THE CLIT(LDUM,*) EQUIVALENT
      DO 65 I=1,4
      A=BIOM(I,N)
      BIOM(I,N)=BIOM(I,N)*EXP(GR(I)-D(I))
      IF (I.LT.2) GO TO 65
      CHANGE=BIOM(I,N)-A
      DO 62 K=2,NFRELM
      IF (CLIT(LDUM,K).LE.0.0) GO TO 62
      CLITQQ(LDUM,K)=CLITQQ(LDUM,K)+CFEPCT(I,K)*CHANGE
      CORGQQ(N,K)=CORGQQ(N,K)-CFEPCT(I,K)*CHANGE
   62 CONTINUE
   65 CONTINUE
C.........CHANGE IN DECOMPOSERS DUE TO DENITRIFICATION
      DCBIO=(EXP(GR(5)-D(5))-1.)*CBIO(N)/CBFAC
      CBIO(N)=CBIO(N)+DCBIO
C.........COMPUTATIONS NEEDED TO INTERFACE WITH SIMULATION SYSTEM
      CLITQQ(LDUM,INIT)=CLITQQ(LDUM,INIT)+V111                   -DHUMNI+
     *  V6TOB3+V7TOB4
      AGAINQ(KA,IAGN)=AGAINQ(KA,IAGN)+V111-V11NH4-V11NO2-V11NO3-V8-V10
      B1(N)=BIOM(1,N)
      FIXN2Q(N)=FIXN2Q(N)+V111-V11NH4-V11NO2-V11NO3
      IL=IL+1
C..........IF NDEBUG SWITCH IS OFF, THEN WRITE ONLY WHEN REPORTS ARE
C..........CALLED FOR
      IF(WRTNIT)GOTO210
      IF((NDEBUG.GT.0).OR.(IDAY.EQ.JDAY))GOTO210
      DO205JJJ=1,20
      IF(MREP(JJJ).LE.0)GOTO220
      IF(IDAY.EQ.MREP(JJJ))GOTO210
  205 CONTINUE
      GOTO220
  210 WRITE(6,3)N,DHUMNI,V11,V111,V11NH4,V11NO2,V11NO3,V6,V7,V8,V10
  220 CONTINUE
    3 FORMAT(I5,10E12.4)
   17 CONTINUE
      RETURN
C-------------------------------------------------------------------------
      ENTRY SNINH
C-************************************************************************
C-.........NAMELIST HANNA REPLACED BY FORMATTED INPUT 1-74 PAUL LOMMEN
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,101)A3,A4,A5,BIOM,BN,BNH4,BNO2,BNO3,B3,B4
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,102)CBFAC,CFEPCT,CION,CM,D1,D2,FVNH4,GM,HETFIX
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,103)IAGN,ICO2,INH4,INIT,INO2,INO3,IR,KA
      READ(5,801)RCHECK
      WRITE(6,802) RCHECK
      READ(5,104)KM3,KM4,K3,K4,LDUM,MAIN3,MAIN4,NNAMLS,PHK,PHMAX,PHMIN
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,105)SA,SYMFIX,T,TMAX,TMIN,VMAX,VOLATL,W,WRTNIT
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
  101 FORMAT(3F10.3/, 5(4F10.5/), 6E11.3)
  102 FORMAT(F10.5/, 6(4F10.5/), E11.3/, 7E11.3/, 2(5F10.5/),
     1 F10.5/, 5F10.5/, L4)
  103 FORMAT(8I5)
  104 FORMAT( 4F10.5/, I5/,2E11.3/, I5/, 4(5F10.5/), 2F10.5)
  105 FORMAT(4(5F10.0/),L4/, 4(5F10.0/), 2F10.0/,F10.0/,L4/,
     * 4(5F10.0/), L4)
  801 FORMAT (20A4)
  802 FORMAT (' ',5X,20A4)
C-.....END NAMELIST REPLACEMENT
C-************************************************************************
      RETURN
      END
```

Subroutine SOWAT

```
 $SET SEPARATE
 $RESET FREE
 $SET OWN
 $SET STACK
      SUBROUTINE SOWAT(ET,RUNOF,WATABS,WATER,SALNTY,EOR,SE1,
C     THIS PROGRAM IS PART OF DESERT BIOME MODEL SOILS IV
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975      PAUL W. LOMMEN
     * ETIME,ETOUT,HROOT,SOILTE)
C..........THIS SUBROUTINE HAS BEEN MODIFIED FROM THE ORIGINAL VERSION
C..........OF GRIFFIN, HANKS, CHILDS, FOR USE  AS PART OF SOILS 4
C...........2-75           PAUL LOMMEN
      DIMENSION RCHECK(20)
      DIMENSION WATABS(5),WATER(5),SALNTY(5),WATH(6),WATL(6),SOILTE(5)
      DIMENSION P(60),D(60),T(60),SS(6),SD(6),C(6),B(6),E(6),F(6)
      DIMENSION H(6),G(6),Y(6),W(6),ROF(6),A(6),DD(6),SE(6)
      LOGICAL IWRITE,TWRITE
      COMMON/SPEC/ NCHAN,INSTRU(20),  NSPECV,NSPECA,NORGAN,NFRACT,
     1 NDAY,NELEM,NOLIT,NCHECK,IDAY,IYRDAY,NREPET(20),NDEBUG,NHORIZ,
     2 NCOH(10),LISCOH(30),NCOHCU(10),NCOHOR,NFRELM,NFRAC1,NSPCOH,MONTH,
     3 HORDEP(6),LITDEP(5),MREP(20),IYR,DRYFAV(3,6),LITCAT(15)
     4,NVECOH,LISVCO(15),NVCOH(10),NVCOCU(10),NOSECS,IRUN,NDEPLT
     5,ISTD,JSTD,ILIT,JLIT,ILH,JLH,SEEDEP(6),NSEEDH ,NELEMS,JSTATE,JDAY
      TIME=0.0
      SE(1)=SE1
      RUNOF=0.0
      CUMS=0.0
      CUMM=0.0
      SUMA=0.0
C-************************************************************************
C----COMPUTATION OF CONDUCTIVITY (B) AND WATER CAPACITY (C)
   16 Y(1)=(W(1)+Y(1))*.5
      J=(Y(1)-T(1))/DELW+1.0
      BB=(Y(1)-T(J))/DELW
      IF (EOR-0.0) 155,156,155
155   G(1)=(P(J+1)-P(J))*BB+P(J)
156   DO 161 I=2,KK
      J=(W(I)-T(1))/DELW+1.0
      BB=(W(I)-T(J))/DELW
      G(I)=(P(J+1)-P(J))*BB+P(J)
      TW=(W(I)-Y(I))+W(I)
      IF (TW-WATH(I)) 157,157,159
  157 IF (TW-WATL(I)) 158,160,160
  158 TW=WATL(I)
```

```
      GO TO 160
  159 TW=WATH(I)
160   Y(I)=W(I)
      W(I)=TW
      SS(I)=SE(I)
161   CONTINUE
      SS(1)=SE(1)
      TOP=WATH(1)
      BOT=WATL(1)
      HKP=H(1)
      WKP=W(1)
      IF (EOR-0.0) 17,19,18
   17 W(1)=WATL(1)
      H(1)=HDRY
      GO TO 19
   18 W(1)=WATH(1)
      H(1)=HWET
19    TWW=(W(1)+Y(1))*0.5
      J=(TWW-T(1))/DELW+1.0
      BB=(TWW-T(J))/DELW
      DIFFA=(D(J+1)-D(J))*BB+D(J)
      HI=(P(J+1)-P(J))*BB+P(J)
      DO 37 I=1,K
      TW=(W(I+1)+Y(I+1))*0.5
      J=(TW -T(1))/DELW+1.0
      BB=(TW-T(J))/DELW
      DIFFB=(D(J+1)-D(J))*BB+D(J)
      GI=(P(J+1)-P(J))*BB+P(J)
  219 IF(HI-GI)20,32,20
20    B(I)=(DIFFA-DIFFB)/(HI-GI)
      IF (I-1) 21,21,33
21    IF (EOR-0.0) 22,33,22
   22 ER=(B(1)*(H(1)*TT-H(2)*TT-G(2)*TW+G(1)*TW+DD(2)))/DD(2)
      IF (ABS(1.1*EOR-ER)-ABS(0.1*EOR)) 236,236,23
23    IF(KCK.EQ.1) GO TO 220
C-*************************************************************************
C-----THE SURFACE PRESSURE HEAD
C-*************************************************************************
      IF (KCK-20)305,236,236
  236 H(1)=(1.1*EOR*DD(2)/B(1)+H(2)*TT-G(1)*TW+G(2)*TW-DD(2))/TT
      IF(H(1).LT.HDRY) H(1)=HDRY
      IF (H(1).GT.HWET) H(1)=HWET
      GO TO 33
220   H(1)=HKP
      W(1)=WKP
      KCK=KCK+1
      GO TO 19
305   KCK=KCK+1
      IF (ER-EOR) 24,33,26
   24 IF (W(1)-WATH(1)) 25,33,33
25    BOT=W(1)
      W(1)=(W(1)+TOP)*0.5
      GO TO 28
   26 IF (W(1)-WATL(1)) 33,33,27
27    TOP=W(1)
      W(1)=(W(1)+BOT)*0.5
   28 J=(W(1)-T(1))/DELW+1.0
      BB=(W(1)-T(J))/DELW
      IF(EOR-0.0)30,33,30
30    H(1)=(P(J+1)-P(J))*BB+P(J)
  218 TWW=(W(1)+Y(1))*0.5
      J=(TWW-T(1))/DELW+1.0
      BB=(TWW-T(J))/DELW
      DIFFA=(D(J+1)-D(J))*BB+D(J)
      HI=(P(J+1)-P(J))*BB+P(J)
      GO TO 219
32    B(I)=(D(J+1)-D(J))/(P(J+1)-P(J))
      IF (I-1) 33,21,33
33    TWW=TW
      HI=GI
      DIFFA=DIFFB
      TW=(W(I+1)+Y(I+1))*0.5
      J=(TW -T(1))/DELW+1.0
35    C(I+1)=DELW/(P(J+1)-P(J))
37    CONTINUE
      KCK=1
      IF(EOR.GT.0.0.AND.ET.GE.0.0) GO TO 6666
      IF(EOR.GT.0.0.AND.ET.LT.0.0) GO TO 5555
 6666 ETPL=ET-EOR
      IF(ET.GE.0.0) GO TO 39
      IF(ETPL-0.0) 365,39,39
 5555 ETPL=ET
C-*************************************************************************
C-     SEARCHING FOR THE PROPER HROOT VALUE
C-*************************************************************************
365   HHOLD=HROOT
      HROOT=HLOW
      SINK=0.0
      DO 250 I=2,K
  250 E(I)=G(I)-36.00 *SE(I)-DD(I)*RRES
      DO 420 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 420
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
420   CONTINUE
      IF ((SINK-ETPL).GT.0.0) GO TO 402
      HROOT=HHOLD
410   HROOT=1.2*HROOT
      SINK=0.0
      DO 421 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 421
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
421   CONTINUE
      IF(SINK-ETPL)411,402,410
411   HRLO=HROOT
      HROOT=HHOLD
      LCOUNT=0
412   HROOT=0.8*HROOT
      LCOUNT=LCOUNT+1
      IF(LCOUNT.EQ.5) GO TO 490
      SINK=0.0
      DO 422 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 422
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
422   CONTINUE
      IF(SINK-ETPL)412,402,413
413   HRHI=HROOT
      GO TO 491
  490 HRHI=HHI
491   LCOUNT=0
      HROOT=HHOLD
405   SINK=0.0
      DO 400 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 400
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
400   CONTINUE
      LCOUNT=LCOUNT+1
      IF(LCOUNT.EQ.20) GO TO 402
      IF(ABS(SINK-ETPL)-0.002)402,402,401
401   IF(SINK-ETPL)403,402,404
403   HRLO=HROOT
      HROOT=0.5*(HROOT+HRHI)
      GO TO 405
404   HRHI=HROOT
      HROOT=0.5*(HROOT+HRLO)
      GO TO 405
   39 DO 251 I=2,K
      SINK=0.0
  251 A(I)=0.0
      GO TO 38
C-*************************************************************************
C-     A IS THE DFL WATER/DELT CAUSED BY PLANT EXTRACTION
C-*************************************************************************
  402 DO 406 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 407
      A(I)=B(I)*(HROOT-E(I))*2.0*RDF(I)/(DD(I+1)-DD(I-1))
      GO TO 406
  407 A(I)=0.0
406   CONTINUE
C-*************************************************************************
C-----COMPUTATION OF TRIDIAGONAL MATRIX MAIN BODY
C-*************************************************************************
38    DO 42 I=2,K
      POT=(DD(I+1)-DD(I-1))/(2.0*DELT)
      DLXA=(DD(I)-DD(I-1))
      DLXB=(DD(I+1)-DD(I))
      BB=C(I)*POT/TT+B(I)/DLXB+B(I-1)/DLXA
      DA=(C(I)*POT*G(I)+(B(I)/DLXB)*(TW*(G(I+1)-G(I))-DLXB)+(B(I-1)/DLXA
     1)*(TW*(G(I-1)-G(I))+DLXA)+A(I)*(DD(I+1)-DD(I-1))*0.5)/TT
      IF(I-2)390,390,40
  390 IF(H(1).GE.HWET.OR.H(1).LE.HDRY) GO TO 394
      DA=DA-((B(I-1)/DLXA)*(TW*(G(I-1)-G(I))+DLXA))/TT+EOR/TT
      BB=BB-B(I-1)/DLXA
      GO TO 393
  394 DA=DA+H(I-1)*B(I-1)/DLXA
  393 F(I)=DA/BB
      E(I)=(B(I)/DLXB)/BB
      GO TO 42
40    IF (I-K) 41,43,43
41    E(I)=(B(I)/DLXB)/(BB-(B(I-1)/DLXA)*E(I-1))
      F(I)=(DA+(B(I-1)/DLXA)*F(I-1))/(BB-(B(I-1)/DLXA)*E(I-1))
   42 CONTINUE
43    BB=BB-TAA*B(I)/DLXB
      DA=DA+TAA*(B(I)/DLXB)*((G(I)-G(I+1))*TW+DLXB)/TT+TBB*B(I)/DLXB*H(
     1KK)
      H(I)=(DA+(B(I-1)/DLXA)*F(I-1))/(BB-(B(I-1)/DLXA)*E(I-1))
44    I=I-1
      H(I)=E(I)*H(I+1)+F(I)
      IF (I-2) 45,45,44
45    IF(TAA-1.0)47,46,46
46    H(KK)=H(K)+DD(KK)-DD(K)
47    DO 60 I=2,KK
300   IF (H(I)-HWET-DD(I)) 60,60,55
55    H(I)=HWET+DD(I)
60    CONTINUE
C-*************************************************************************
C-----COMPUTATION OF WATER CONTENTS AS A FUNCTION OF PRESSURES JUST COMP
C-*************************************************************************
      IF(H(1).GE.HWET.OR.H(1).LE.HDRY) GO TO 1005
      WFOD=EOR
      H(1)=(EOR*DD(2)/B(1)+H(2)*TT-G(1)*TW+G(2)*TW-DD(2))/TT
      IF(H(1).LT.HDRY) H(1)=HDRY
      IF (H(1).GT.HWET) H(1)=HWET
      GO TO 134
 1005 WFOD=B(1)*((H(1)-H(2))*TT+(G(1)-G(2))*TW+DD(2))/DD(2)
134   I=1
62    IF (H(I)-G(I)) 65,116,65
65    NHI=54
      NLO=1
      J=25
66    IF (H(I)-P(J)) 67,72,68
67    NHI=J
      GO TO 69
68    NLO=J
69    JT=J
      J=(NHI-NLO)/2+NLO
      IF (J-JT) 66,70,66
70    IF (H(I)-P(J)) 71,72,72
71    J=J-1
72    WAT=(H(I)-P(J))*DELW/(P(J+1)-P(J))+T(J)
      W(I)=WAT
      GO TO 117
116   W(I)=Y(I)
  117 DO 268 I=2,KK
      W(I)=C(I)*(H(I)-G(I))+Y(I)
      IF (W(I).GT.WATH(I)) W(I)=WATH(I)
  268 IF (W(I).LT.WATL(I)) W(I)=WATL(I)
269   SUM3=0.0
      SUM2=0.0
      SUM1=0.0
      DO 131 I=2,K
      SUM1=W(I)+SUM1
      SUM2=Y(I)+SUM2
      IF (ABS(SUM1-SUM2)-ABS(SUM3)) 131,131,130
130   SUM3=SUM1-SUM2
131   CONTINUE
      IF(ABS(SUM3)-ABS(CONQ))63,63,132
132   IF(DELT-DETT*0.1)63,63,133
  133 DELT=0.5*DELT
      GO TO 38
   63 SUM1=0.0
      SUM2=0.0
      DO 800 I=2,K
      SUM1=W(I)*(DD(I+1)-DD(I-1))/2.+SUM1
  800 SUM2=Y(I)*(DD(I+1)-DD(I-1))/2.+SUM2
      CWF=SUM1-PIT
      CUMS=WFOD*DELT+CUMS
      SUMA=SUMA+SINK*DELT
      CWFLX=(SUM1-SUM2)
C-*************************************************************************
C-----SALT LOOP
C-*************************************************************************
      KB=K-1
      WFRU=B(1)*((H(1)-H(2))*TT+(G(1)-G(2))*TW+DD(2))/DD(2)
      DO 214 I=2,K
      DLXA=(DD(I)-DD(I-1))
      DLXB=(DD(I+1)-DD(I))
      DLXC=(DD(I+1)-DD(I-1))*0.5
      WFRD=B(I)*((H(I)-H(I+1))*TT+(G(I)-G(I+1))*TW+DLXB)/DLXB
  176 WATD=(Y(I)*TW+W(I)*TT+Y(I+1)*TW+W(I+1)*TT)/2.0
      DISD=DLXC*0.5*WFRD-(W(I)-Y(I))*(WFRD+WFRU)*WFRD*DELT/(8.0*WATD*
     1(W(I)+Y(I)))
      BETA=DIFU*DIFA*EXP(DIFB*WATD)+ALAMBA*ABS(WFRD/WATD)-DISD
      IF (I .GT. 2) GO TO 680
      ALFA=0.0
      IF (WFRU .GT. 0.0) GO TO 182
      WFRU=0.0
      GO TO 182
  680 WATU =(Y(I)*TW+W(I)*TT+Y(I-1)*TW+W(I-1)*TT)/2.0
      DISU=DLXC*0.5*WFRU-(W(I)-Y(I))*(WFRD+WFRU)*WFRU*DELT/(8.0*WATU*
     1(W(I)+Y(I)))
      ALFA=DIFU*DIFA*EXP(DIFB*WATU)+ALAMBA*ABS(WFRU/WATU)-DISU
      IF (WFRU .GE. 0.0) GO TO 182
      UP=0.0
      GO TO 183
  182 UP=1.0
  183 DN=1.0-UP
```

```
      IF (WFRD .GE. 0.0) GO TO 185
      UPP=0.0
      GO TO 186
  185 UPP=1.0
  186 DNN=1.0-UPP
      SE(I)=(DLXC*Y(I)*SS(I)/DELT+ALFA*(SS(I-1)-SS(I))/DLXA-BETA*(SS(I)-
     1SS(I+1))/DLXB-WFRD*(SS(I)*UPP+SS(I+1)*DNN)+WFRU*(SS(I-1)*UP+SS(I)
     2*DN)+SOURCE*DLXC)*DELT/(W(I)*DLXC)
      SE(I)=SS(I)+(SE(I)-SS(I))*SOCON
  214 WFRU=WFRD
      SE(KK)=SS(KK)
      SD(1)=SE(1)*W(1)
      DO 217 I=2,KK
  217 SD(I)=SE(I)*W(I)
706   IF(EOR-0.0)136,136,135
  135 RUNOF=RUNOF+(EOR-WFDD)*DELT*10.
136   TIME=TIME+DELT
      IF (SUM3-0.0) 139,301,139
  301 DELT=2.0*DELT
      GO TO 145
139   TW=ABS(CONQ*DELT/SUM3)
140   IF (TW-0.1*DETT) 141,142,142
  141 TW=0.1*DETT
      GO TO 144
  142 IF(TW-1000.0*DETT)144,144,143
  143 TW=1000.0*DETT
  144 IF(TW.GT.2.0*DELT) GO TO 301
      DELT=TW
C-*******************************************************************
C----TEST TO SEE IF EVAP OR RAIN INTENSITY (EOR) HAS CHANGED
C-*******************************************************************
  145 IF (TIME-ETIME)148,147,148
  147 IF(            (NDEBUG.GT.0).OR.(IDAY.EQ.JDAY))GOTO807
      DO7777 JJJ=1,20
      IF(MREP(JJJ).LE.0)GOTO1480
      IF(IDAY.EQ.MREP(JJJ))GOTO807
 7777 CONTINUE
      GOTO1480
  807 CONTINUE
      WRITE (6,666)
      WRITE (6,168)(DD(I),W(I),H(I),A(I),SE(I),SD(I),SOILTE(I),I=1,K)
      WRITE (6,169) (DD(KK),W(KK),H(KK),A(KK),SE(KK),SD(KK))
      WRITE (6,184)
      WRITE(6,167) IDAY,TIME,ET,EOR,SUMA,RUNOF,HROOT,CWF,CUMS
 1480 DELT=DETT
      GO TO 162
  148 IF (TIME+DELT-ETIME) 16,16,149
  149 DELT=ETIME-TIME
      GO TO 16
  162 CONTINUE
      DO 1000 I=2,KK
C..........WATER IN ATM, WAS IN CM) 1030CM=1 ATM.   4.853E-4=.5/1030
      WATER(I-1)=(H(I-1)+H(I))*4.853E-4
      WATABS(I-1)= ((W(I)+W(I-1))*0.5)*(DD(I)-DD(I-1))*10.
      SALNTY(I-1)=SD(I)
 1000 CONTINUE
      ETOUT=SUMA*10.
C-*******************************************************************
166   FORMAT (11E11.4)
  167 FORMAT (4X,I3,8(E12.4),//)
  666 FORMAT (4X,'DEPTH',7X,'WATER',6X,'POTENTIAL',3X,'ROOT EXT.'
     1,4X,'SALT CONC',4X,'AMT SALT', 4X, 'TEMP AT MID-HORIZ')
  168 FORMAT(3X,F7.1,3X,F7.4,3X,E12.4,1X,E12.4,6X,F7.2,3X,F7.2,10X,F7.2)
  169 FORMAT(3X,F7.1,3X,F7.4,3X,E12.4,1X,E12.4,6X,F7.2,3X,F7.2)
170   FORMAT (119H   WATER    POTENTIAL   CONDUCTIVITY DIFFUSIVITY
     1C(I)     DEPTH        W-DEPTH      H-DEPTH      ROF-DEPTH    SE-DEPTH)
172   FORMAT (53H   HDRY          HWET          WATL(KK)      WATH(KK)      CB)
180   FORMAT (66H  DELX          DETT          GRAVY         CONQ          DELW
     1        TIME)
181   FORMAT (66H   TT            CUMT          TAA           HLOW          HHI
     1        RRES)
  184 FORMAT (4X,'DAY',3X,'CUM. HOURS',2X,'ET        ',4X,'EOR       ',
     *'CUM.TRANS.   RUNOFF        HROOT         CWF           CUMS')
  274 FORMAT (11E12.4)
  284 FORMAT(68H    ALAMBA        SOURCE        DIFO          DIFA          DIFB
     1        SOCON)
      RETURN
C-*******************************************************************
      ENTRY ENTWAT
C-*******************************************************************
C-------------------------------------------------------------------
C-.........NAMELIST WATIN REPLACED BY FORMATTED INPUT 1-74 PAUL LOMMEN
      READ(5,801)RCHECK
      WRITE(6,802)  RCHECK
      READ (5,100) ALAMBA, CB, CONQ, CUMT, D, DD, DETT, DELW,
     *  DELX, DIFA, DIFB, DIFO, DTIME
      READ(5,801)RCHECK
      WRITE(6,802)  RCHECK
      READ(5,101) GRAVY,HDRY,HWET,HLOW,HHI, IWRITE ,
     *  K, KK, MM, NB, ND, P, ROF, RRES
      READ(5,801)RCHECK
      WRITE(6,802) RCHECK
      READ(5,102) SE,SOCON,SOURCE,TAA,TIME,TT,        W,WATL,WATH
      READ(5,801)RCHECK
      WRITE(6,802) RCHECK
  100 FORMAT(4F10.5/, 10(6E12.4/), 6E11.3/, 7F10.5)
  101 FORMAT(F10.5/, 2E11.3/, 2E11.3/,L4/, 5I5/, 10(6E11.3/),
     1  6F10.5/, F10.5)
  102 FORMAT(6E11.3/, 5F10.5/,      2(6F10.5/),6F10.5)
  801 FORMAT (20A4)
  802 FORMAT (' ',5X,20A4)
C-.........END NAMELIST REPLACEMENT
C-------------------------------------------------------------------
C-*******************************************************************
C-        THIS SECTION OF SOWAT CALCULATES AND WRITES INITIAL TABLES
C-        AFTER ALL DATA RELVANT TO SOILS SUBROUTINE  HAVE BEEN READ IN
      WFDD=-.009
      LL=MM
      DO 4 I=1,KK
    4 SE(I)=(SE(I)*10.)/(W(I)/WATH(I))
      P(1)=P(1)*1.0E+03
      T(1)=0.0
      DO 900 I=2,ND
      T(I)=DELW+T(I-1)
900   P(I)=P(I)*1.0E+03
      SMAX=350.
      CWFLX=0.0
      DELT=DETT
      TW=1.0-TT
      TBB=1.0-TAA
      DO 14 I=1,KK
      SS(I)=SE(I)
      SD(I)=SE(I)*W(I)
14    Y(I)=W(I)
      PIT=0.0
      DO 15 I=2,K
   15 PIT=W(I)*(DD(I+1)-DD(I-1))/2.+PIT
      IF (IWRITE) WRITE(6,170)
      TW=D(1)
      D(1)=(D(1)*(P(2)-P(1)))*CH
      J=(W(1)-T(1))/DELW+1.0
      H(1)=(P(J+1)-P(J))*(W(1)-T(J))/DELW+P(J)
      G(1)=H(1)
      C(1)=DELW/(P(J+1)-P(J))
      IF (IWRITE) WRITE(6,274)  T(1),P(1),TW,D(1),C(1),DD(1),W(1),H(1),
     *  ROF(1),SE(1)
      DO 3 I=2,KK
      TW=D(I)
      D(I)=D(I)*(P(I)-P(I-1))*CB+D(I-1)
      J=(W(I)-T(1))/DELW+1.0
      H(I)=(P(J+1)-P(J))*(W(I)-T(J))/DELW+P(J)
      C(I)=DELW/(P(J+1)-P(J))
      G(I)=H(I)
      IF (IWRITE) WRITE(6,274)  T(I),P(I),TW,D(I),C(I),DD(I),W(I),H(I),
     *  ROF(I),SE(I)
3     CONTINUE
      N=KK+1
      DO 2 I=N,ND
      TW=D(I)
      D(I)=D(I)*(P(I)-P(I-1))*CB+D(I-1)
    2 IF (IWRITE) WRITE(6,274) T(I),P(I),TW,D(I)
C-*******************************************************************
      IF (.NOT.IWRITE) GO TO 11
      WRITE (6,180)
      WRITE (6,166) DELX,DETT,GRAVY,CONQ,DELW,TIME
      WRITE (6,181)
      WRITE (6,166) TT,CUMT,TAA,HLOW,HHI,RRES
      WRITE (6,172)
      WRITE(6,166) HDRY,HWET,(WATL(I),WATH(I),I=1,KK),CB
      WRITE (6,284)
      WRITE (6,274) ALAMBA,SOURCE,DIFO,DIFA,DIFB,SOCON
   11 KCK=1
      HROOT=G(2)
      RETURN
      END
```

Subroutine SOILS

```
 $SET STACK
 $SET SEPARATE
 $SET OWN
 $RESET FREE
      SUBROUTINE SOILS
C     THIS PROGRAM IS PART OF DESERT BIOME MODEL SOILS IV
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975     PAUL W. LOMMEN
C-.........NAMELIST CHANGED TO FORMATTED INPUT
C-..........THIS IS ESSENTIALLY SOILS 3 OF JOHN RADFORD
C-..........SMALL CHANGES HAVE BEEN MADE SO THAT NITRO AND DECOMP
C-..........OF HANNA PARNAS CAN BE CALLED, AND SO THAT SOWAT
C-..........OF GRIFFIN,HANKS,CHILDS AS ADAPTED BY JOHN RADFORD
C-..........CAN BE CALLED


C     NOTE- ALL VARIABLES(UNLESS NOTED) WITH NAMES BEGINNING WITH THE
C     LETTER I,J,K,L,M, OR N ARE AUTOMATICALLY INTEGER VARIABLES. SOME
C     PARAMETERS HAVE DEFAULT VALUES GIVEN IN THE 'DATA' STATEMENT.
C     TWO TIME UNITS ARE USED HEREIN, 'GENERAL' AND 'INFILTRATION'. IN-
C     TERCEPTION AND INFILTRATION OPERATE WITH THE 'INFILTRATION' UNIT
C     WHICH IS AN EVEN DIVISOR OF THE GENERAL ONE. USUALLY, THE INFIL-
C     TRATION TIME UNIT IS AN HOUR, THERE BEING A MAXIMUM(MTU) OF 24 OF
C     THESE IN THE USUAL ONE DAY GENERAL UNIT.  THE NUMBER OF INFILTR-
C     ATION TIME UNITS IS GREATER THAN OR EQUAL TO 1. ALL WATER VARIA-
C     BLES(EXCEPT 'SNOCOV') USED IN THE PROGRAM HAVE THE SAME UNITS.
C     PARAMETERS WILL HAVE DEFAULT VALUES OF ZERO UNLESS SPECIFIED IN
C     'DATA' OR READ IN AS NAMELIST DATA EXPLICITLY
C     FOR MORE DETAILS- SEE BIOME SEPARATES OR THE 1973 PROGRESS REPORT
C AHFAC             UNITS OF RAIN(FALLING ON VEGETATIVE COVER) PER UNIT
C                   'AVHT',WHICH ARE COMPLETELY INTERCEPTED. AVHT*AHFAC
C                   IS THE AMOUNT OF RAIN INTERCEPTED BEFORE BHFAC IS USED
C AVINRT(I)         AVERAGE INFILTRATION RATE DURING AN INFILTRATION TIME
C                   UNIT GIVEN THAT SOIL WATER CONTENT IS INITIALLY IN THE
C                   I'TH TENTH OF THE INTERVAL 0 TO SATURATION,LENGTH/TIME
C BC(IH)            BOUNDARY CONDITIONS FOR WATER OR THE CONSTANT AMOUNT
C                   OF WATER INPUT TO OR OUTPUT FROM HORIZON IH ARTIFIC-
C                   IALLY, LENGTH/TIME
C BHFAC             FRACTION OF RAINFALL INTERCEPTED PER UNIT LENGTH OF
C                   AVERAGE VEGETATIVE HEIGHT AFTER THE AMOUNT AHFAC*AVHT
C                   HAS BEEN INTERCEPTED
C CFEPCT(K)         UNITS OF CONSTITUENT K ADDED TO CRUST PER UNIT CRUST
C                   CARBON FIXATION
C CONFAC            UNITS OF MASS OF WATER PER UNIT  OF LENGTH OF WATER.
C                   THIS IS A CONVERSION FACTOR WHICH HAS AS DEFAULT VALUE
C                   1.E+07 FOR CONVERSION OF MM-HA TO G/HA
C COVFAC(IC)        FRACTION (USUALLY) OF ONE WHICH IS MULTIPLIED BY THE
C                   POTENTIAL EROSION (USUALLY CALCULATED FOR BARE SOIL)
C                   TO GET A NEW POTENTIAL GIVEN IC TENTHS PLANT COVER
C CPRATE(IS)        UNITS OF CARBON FIXED PER GENERAL TIME UNIT PER UNIT
C                   OF TOTAL CARBON PRESENT,FOR SEASON IS
C CTRANS(IS)        FRACTION OF SIMULATED AREA COVERED BY ANNUALS AND PER-
C                   ENNIALS(HIGHER VASCULAR TRANSPIRING PLANTS) IN SEASON
C                   IS. IF IVC IS .GT. 0, CTRANS IS CALCULATED BY USING
C                   OUTPUT FROM THE VEGET SUBROUTINE
C DFPERO(I)         DEPTH TO WHICH EROSION HAS AN EFFECT GIVEN THAT POTEN-
C                   TIAL FINE SAND EROSION IS GREATER THAN ERODED(I-1) AND
C                   LESS THAN ERODED(I)
C DFAC(IH)          CURVATURE FACTOR FOR THE THE EXPONENTIAL RELATIONSHIP
C                   (WATER CONTENT V. CHANGE IN WATER CONTENT), HORIZON IH
C DMAXDN(IH)        FRACTION OF WATER IN AN INITIALLY SATURATED HORIZON IH
C                   THAT WILL FLOW DOWN INTO THE NEXT LOWER(DRY) HORIZON
C                   IH+1 IN ONE TIME UNIT
C DMAXUP(IH)        FRACTION OF THE WATER IN AN INITIALLY SATURATED HORI-
C                   ZON IH THAT WILL FLOW UP INTO THE NEXT (DRY) UPPER
C                   HORIZON IH-1 IN ONE TIME UNIT
C DNITL(IL,IS)      UNITS OF NITROGEN(TOTAL) IN DETRITUS TYPE IL LOST TO
C                   THE ATMOSPHERE PER UNIT NITROGEN PRESENT IN DETRITUS
C                   TYPE IL PER UNIT TIME,FOR SEASON IS
C DNITD(IS)         UNITS TOTAL NITROGEN IN SOIL ORGANIC MATTER LOST TO
C                   ATMOSPHERE PER UNIT TIME PER UNIT NITROGEN PRESENT IN
C                   SOIL ORGANIC MATTER,FOR SEASON IS
C EFAC(IS)          FRACTION OF ONE INDICATING RELATIVE RESISTANCE OF SOIL
C                   TO EVAPORATION WHICH IS NOT ACCOUNTED FOR BY DEGREE OF
C                   PLANT COVER AND SOIL WATER CONTENT. FOR SEASON IS
C EMDIRT(IH)        RELATIVE EROSIONAL MOBILITY OF THE INORGANIC SOIL MAT-
C                   RIX OF HORIZON IH(MOBILITY OF FINE SAND = 1)
C EMLIT(IL)         RELATIVE EROSIONAL MOBILITY OF DETRITUS TYPE IL
C EMNUT             RELATIVE EROSIONAL MOBILITY OF SOIL MINERAL NUTRIENTS
C EMORG             RELATIVE EROSIONAL MOBILITY OF SOIL ORGANIC MATTER
C ERODED(I)         MAXIMUM WEIGHT OF POTENTIAL FINE SAND EROSION ALLOWING
C                   EROSION TO HAVE AN EFFECT NO DEEPER THAN DEPERO(I)
C FNIT(N,IS)        UNITS OF NITROGEN FIXED PER TIME UNIT PER UNIT OF THE
C                   TOTAL CARBON FIXED FOR  CRUST(N=ICF) OR IN SYMBIOTIC
C                   HOST PLANT ROOTS(N=ISF) OR IN SOIL ORGANIC MATTER
C                   (N=IFF), ACCORDING TO SEASON IS
C FROZEN            LOGICAL VARIABLE WITH VALUE .TRUE. IF SOIL IS PRESENT-
C                   LY FROZEN, .FALSE. IF NOT. DEFAULT IS .FALSE.
C FRZWNS            TEMPERATURE BELOW WHICH THE ENTIRE SOIL FREEZES IF NO
C                   SNOW IS PRESENT
C FRZWS             TEMPERATURE BELOW WHICH SOIL WILL FREEZE IF SNOW IS
C                   PRESENT AND LESS THAN THE DEPTH SNOWIN
C FWMAX             MAXIMUM(LENGTH) DEPTH OF STANDING FREE WATER
C FWMAXC            MAXIMUM DEPTH OF FREE WATER ALLOWING CRUST GROWTH
```

```
C FWMAXE          MAXIMUM FREE WATER DEPTH ALLOWING NON-AERIAL EROSIONS
C GTU(IS)         AVERAGE DURATION OF GUSTS DURING SEASON IS AS A FRACT-
C                 ION OF THE GENERAL TIME UNIT
C HORWT(IH)       WEIGHT OF THE INORGANIC MATRIX OF HORIZON IH MATERIALS
C HRTFAC(IH,IS)   CONSTANT BY WHICH THE BIOLOGICAL AND RELATED RATES OF
C                 THE STANDARD HORIZON ARE MULTIPLIED TO GET ACTUAL
C                 RATES FOR SEASON IS AND HORIZON IH. STANDARD HORIZON
C                 IS ANY ONE DESIRED(BUT ONLY ONE)
C HWIDTH(IH)      WIDTH OF HORIZON IH
C H2WFAC          FACTOR RELATING VEGETATIVE HEIGHT TO WIND EROSION
C IAG(K)          POSITION POINTER FOR CONSTITUENT K INDICATING WHERE IN
C                 THE AGAIN(*,IAG(K)) ARRAY K WILL BE ACCOUNTED
C ICF             POSITION POINTER IN THE FNIT(N,*) ARRAY FOR CRUST NIT-
C                 ROGEN FIXATION. IF ICF .LE. 0, THIS FIXATION IGNORED
C ICRS            POSITION POINTER INDICATING WHICH PART OF THE CLIT
C                 ARRAY CORRESPONDS TO CRUST(CLIT(ICRS,*)). IF ICRS .LE.
C                 ZERO, ALL CRUST ACTIVITY IS IGNORED
C IDAYBS          YEARDAY FROM JANUARY FIRST ON WHICH THE SNOW ACCUMU-
C                 LATOR FOR GRAPHING SNOWFALL WILL BE SET TO THE PRESENT
C                 VALUE OF SNOCOV
C IDUM            POINTER INDICATING WHERE IN THE DUMMY ARRAY THE FIRST
C                 SOILS 'DUMMY' GRAPH VALUE OCCURS
C IEN             CONSTITUENT NUMBER CORRESPONDING TO TOTAL NITROGEN
C                 OR TO THE TYPE OF NITROGEN THAT CAN BE EXCHANGED WITH
C                 THE ATMOSPHERE
C IEXDAY(IX)      SIMULATION DAY,FROM THE BEGINNING OF THE INITIAL SIM-
C                 ULATION YEAR , ON WHICH ONE WISHES TO CALL EXOGEN FOR
C                 THE IX'TH TIME
C IFF             POINTER FOR THE ARRAY FNIT INDICATING THE POSITIONS IN
C                 THE ARRAY INVOLVED WITH HETEROTROPHIC FIXATION. IF
C                 IFF=0, THIS TYPE OF FIXATION IS IGNORED
C INAM            COUNTER ASSOCIATED WITH NAMDAY
C IS              PRESENT SEASON NUMBER
C ISALT           CONSTITUENT NUMBER OF THE FIRST SALT CONSTITUENT(NON-
C                 NITROGEN, NON-CARBON)
C ISEND(IS)       YEARDAY OF THE END OF SEASON IS
C ISF             POINTER FOR THE ARRAY FNIT(ISF,*) USED TO INDICATE THE
C                 POSITIONS OCCUPIED BY SYMBIOTIC FIXATION RATES. IF ISF
C                 .LE.0,SYMBIOTIC FIXATION IS IGNORED
C ITUWF           COUNTER SET TO ZERO AFTER EVERY INFILTRATION EVENT AND
C                 INCREMENTED BY 1 EACH TIME UNIT THEREAFTER
C IVC(I)          POINTER INDICATING IN THE ARRAY COVER THE POSITION OF
C                 THE I'TH PLANT SPECIES USED TO CALCULATE AVERAGE VEGE-
C                 TATIVE HEIGHT
C IVH             ORGAN NUMBER OF FIRST PLANT ROOT CATEGORY IN 'CVEG'
C IVNODS(I)       POINTER INDICATING THE POSITION IN THE ARRAY CVEG COR-
C                 RESPONDING TO THE I'TH PLANT SPECIES INVOLVED IN SYM-
C                 BIOTIC NITROGEN FIXATION
C IX              COUNTER ASSOCIATED WITH IEXDAY
C JDUM            VALUE OF 'IDUM' PLUS THE NUMBER OF SOIL HORIZONS - 1
C JSALT           CONSTITUENT NUMBER OF THE LAST SALT ELEMENT(SEE ISALT)
C JVH             ORGAN NUMBER OF  LAST PLANT ROOT CATEGORY IN 'CVEG'
C KA              POINTER FOR THE ATMOSPHERIC ROUTE OF EXCHANGE
C KG              POINTER FOR THE SUBSOIL ROUTE OF EXCHANGE
C KS              POINTER FOR THE SURFACE ROUTE OF EXCHANGE
C KSAT(IH)        SATURATED CONDUCTIVITY OF HORIZON IH, DECIMAL VALUE OF
C                 LENGTH/TIME
C L1              TYPE NUMBER OF THE FIRST SINGLY-DIVIDED DETRITUS TYPE
C L2L(IL)         TYPE NUMBER OF THE DETRITUS TYPE INTO WHICH TYPE IL
C                 CAN BE DIVIDED(SINGLY-DIVIDED TYPES). IF L2L(IL) .LE.0
C                 THEN TYPE IL IS NOT TRANSFORMED
C L2LDIV(I,IL)    TYPE NUMBER OF THE DETRITUS TYPE INTO WHICH THE I'TH
C                 DIVISION OF TYPE IL CAN BE TRANSFORMED.IF L2LDIV(I,IL)
C                 .LE. 0 THEN DIVISION I OF TYPE IL IS NOT TRANSFORMED
C MYU             MAXIMUM NUMBER OF INFILTRATION TIME UNITS PER GENERAL
C                 SIMULATION TIME UNIT
C NAMDAY(INAM)    SIMULATION DAY, FROM THE BEGINNING OF THE INITIAL SIM-
C                 ULATION YEAR, ON WHICH ONE WISHES TO READ IN A NEW
C                 SET OF NAMELIST 'IN' VALUES
C NBC             INTEGER 'SWITCH'. IF NBC .LE. 0, 'BC' IS  NOT USED
C NDEP            NUMBER OF DEPTHS ASSOCIATED WITH DEPERO
C NDH2SE          NUMBER OF HORIZONS FROM WHICH EVAPORATION CAN BE EX-
C                 TRACTED DIRECTLY
C NDIVLS          NUMBER OF DETRITUS TYPES THAT CAN BE MULTIPLY DIVIDED
C NGUST(IS)       AVERAGE NUMBER OF GUSTS PER GENERAL TIME UNIT IN SEA-
C                 SON IS. IF .LE. 0, GUSTING IS IGNORED
C NLDIVS          MAXIMUM NUMBER OF DIVISIONS OF A SINGLE DETRITUS TYPE
C NS              NUMBER OF SEASONS
C NSTORM          NUMBER OF STORM CATEGORIES ASSOCIATED WITH 'STORM'
C NTUWF           MAXIMUM NUMBER OF GENERAL TIME UNITS ALLOWED FOR WATER
C                 FLOW CALCULATIONS BETWEEN INFILTRATION EVENTS
C NVC             INTEGER 'SWITCH', IF .LE. 0, CTRANS AND VHT ARRAYS ARE
C                 GIVEN DATA  VALUES. IF .GT. 0, ARRAYS ARE CALCULATED
C                 FROM OUTPUT OF THE VEGET SUBROUTINE
C NVNODS          NUMBER OF PLANT SPECIES INVOLVED IN SYMBIOSIS
C NVR             NUMBER OF ROOT ZONES IN THE SOIL. IF .LE. 0, VALUES FOR
C                 RDF MUST BE SUPPLIED. OTHERWISE, RDF IS CALCULATED BY
C                 USING DATA FROM VEGET SUBROUTINE.
C PCTSAT(IH)      PERCENTAGE SATURATION OF HORIZON IH
C POTDRY          MINIMUM SOIL WATER POTENTIAL ALLOWING BIOLOGICAL TYPE
C                 ACTIVITY
C POTWET          MAXIMUM SOIL WATER POTENTIAL FOR BIOLOGICAL ACTIVITY
C RDF(IS,IH)      FRACTION OF ALL LIVE ROOTS IN HORIZON IH IN SEASON IS
C RTLDIV(IS,I,IL) UNITS OF ALL OF THE DETRITUS TYPE IL TRANSFORMED INTO
C                 TYPE L2LDIV(I,IL) PER UNIT OF TYPE IL PRESENT PER TIME
C                 UNIT, FOR SEASON IS
C RTL2L(IL,IS)    UNITS OF DETRITUS TYPE IL TRANSFORMED TO TYPE L2L(IL)
C                 PER UNIT OF TYPE IL PRESENT PER TIME UNIT, SEASON IS
C RUNFAC          AMOUNT(WEIGHT) OF LOOSE FINE SAND THAT CAN BE ERODED
C                 FROM SIMULATED AREA IF SOIL IS BARE AND RUNOFF = 10MM
C SBFAC(IS)       FRACTION OF FRESH SNOW BLOWN OFF DURING SEASON IS
C SC2SO           UNITS(LENGTH) SNOW DEPTH OF UNMELTED SNOW PER UNIT OF
C                 EQUIVALENT WATER OF UNMELTED SNOW(E.G., 10)
C SFLOW(K)        UNITS OF CONSTITUENT K EXTRACTED  FROM AND TRANSPORTED
C                 BETWEEN HORIZONS BY WATER FLOW PER UNIT (LENGTH) FLOW
C SMFAC(IS)       UNITS(LENGTH) OF SNOW MELTED(WATER EQUIVALENT) IN A
C                 GENERAL TIME UNIT PER DEGREE AVERAGE TEMPERATURE ABOVE
C                 THE MINIMUM SMTEMP(IS), SEASON IS
C SMTEMP(IS)      MINIMUM TEMPERATURE FOR SNOW MELTING IN SEASON IS
C SM2RN           UNITS(LENGTH) SNOW MELT(WATER EQUIVALENT) PER UNIT(LEN
C                 GTH) LIQUID WATER IN CONTACT WITH UNMELTED SNOW
C SNOMIN          SNOW DEPTH ASSOCIATED WITH 'FRZWS'
C SNOMXE          MAXIMUM ACTUAL DEPTH OF SNOW ALLOWING ANY WIND EROSION
C SNOWAT          UNITS(LENGTH) OF WATER STORED IN UNMELTED SNOW
C SNOWMM          SNOW DEPTH OF UNMELTED SNOW
C STORM(I)        UPPER LIMIT(LENGTH) ON STORM SIZE INTERVAL I AS USED
C                 IN DETERMINING RAINFALL RATE WITH 'ARR'
C SWRFAC          UNITS LIQUID WATER(LENGTH) THAT CAN BE STORED IN UN-
C                 MELTED SNOW PER UNIT(WATER EQUIVALENT LENGTH) SNOW
C SWT1(IH)        SOIL WATER CONTENT(LENGTH) OF HORIZON IH BELOW WHICH
C                 EVAPOTRANSPIRATION IS NOT ALLOWED
C SWT2(I,IH)      SOIL WATER CONTENT(LENGTH) OF HORIZON IH BELOW WHICH
C                 ACTUAL EVAPOTRANSPIRATION BEGINS TO FALL FALL BELOW
C                 POTENTIAL, GIVEN A VAPOR DEMAND(EVAP) IN THE RANGE OF
C                 I=MIN(5,(.5*EVAP+1)), AN INTEGER DERIVED BY TRUNCATION
C TFAC(IS)        RELATIVE FACTOR NEEDED TO INCREASE OR DECREASE TRANS-
C                 PIRATION WHEN NOT ALL VARIATION IN TRANSPIRATION IS
C                 EXPLAINED BY VARIATION IN PLANT COVER, ROOT DISTRIBU-
C                 TION AND SOIL WATER CONTENT, FOR SEASON IS
C VCOVER(IS)      TOTAL FRACTIONAL PLANT COVER FOR SEASON IS
C VHT(I)          HEIGHT(LENGTH) OF THE AVERAGE PLANT OF PLANT TYPE
C                 IVC(I), IF NVC .LE. 0, VHT(I) IS AVERAGE HEIGHT FOR
C                 THE ENTIRE VEGETATED AREA
C V2APCT          FRACTION OF INTERCEPTED RAINFALL RETURNING TO AIR
C WATABS(IH)      AMOUNT(LENGTH) OF WATER IN HORIZON IH
C WATER(IH)       SOIL WATER POTENTIAL(BARS) FOR HORIZON IH
C WATGC(IH)       WATABS OF IH AT FULL SATURATION
C WATPOT(I)       SOIL WATER POTENTIAL(BARS) CORRESPONDING TO THE INTER-
C                 VAL I=25*(WATABS(IH)/WATGC(IH))+1
C WERFAC          AMOUNT(WEIGHT) OF FINE LOOSE SAND THAT CAN BE ERODED
C                 FROM THE SIMULATED AREA GIVEN NO PLANT COVER AND AN
C                 AVERAGE WIND SPEED OF 10 M/SEC

C-----------------------------------------------------------------------

      DIMENSION RCHECK(20)
      DIMENSION
     *               AVINRT(10) ,BC(5)        ,CFEPCT(6)  ,COVFAC(10) ,
     * CPRATE(8)  ,CTRANS(8)   ,
     * DEPERO(6)  ,DFAC(5)                   ,DMAXDN(5)  ,DMAXUP(5)   ,
     * DNITL(15,8),                           EFAC(8)    ,EMDIRT(5)   ,
     * EMLIT(15)  ,ERODED(6)  ,EROPCT(5)    ,FLOWDN(5)  ,FLOWUP(5),
     * FNIT(3,8)  ,GTU(8)     ,HORWT(5)     ,HRTFAC(8)  ,HWIDTH(5)   ,
     * IAG(6)     ,IEXDAY(5)  ,ISEND(8)     ,IVC(10)    ,IVNODS(5)   ,
     * KSAT(5)    ,L2L(15)    ,L2LDIV(3,5),NAMDAY(5)    ,NGUST(8)    ,
     * PCTSAT(5)  ,RDF(8,5)                 ,RTLDIV(8,3,5),
     * RTL2L(15,8),SBFAC(8)   ,SFLOW(6)     ,SMFAC(8)   ,SMTEMP(8)   ,
     * STORM(8)   ,SWT1(5)    ,SWT2(5,5)    ,TFAC(8)    ,VCOVER(8)   ,
     *VHT(10)                 ,WATGC(5)
      DIMENSION SALNTY(5)
C-
C-.........SPECIFICATION OF VARIABLES THAT ARE COMMON
C-.........DEFINITIONS ARE IN THE MAIN PROGRAM. NOTE THAT THE VARIABLES
C-.........LITDEP,NDEPLT,DDEPHI,DDEPOR,DDEPLT CORRESPOND TO THE VARIA-
C-.........BLES LITRUN,NRUNLT,DRUNHI,DRUNOR,DRUNLT IN OTHER PROGRAMS
      COMMON /ACCINC/ AGAINQ(3,4),ERODQQ(3), H20QQQ(3)
      COMMON/SPEC/ NCHAN,INSTRU(20),  NSPECV,NSPECA,NORGAN,NFRACT,
     1 NDAY,NELEM,NOLIT,NCHECK,IDAY,IYRDAY,NREPET(20),NDEBUG,NHORIZ,
     2 NCOM(10),LISCOM(30),NCOMCU(10),NCOHOR,NFRELM,NFRAC1,NSPCOM,MONTH,
     3 HORDEP(6),LITDEP(5),MMEP(20),IYR,DRYFAV(3,6),LITCAT(15)
     4,NVECOM,LISVCO(15),NVCOM(10),NVCUCU(10),NOSECS,IRUN,NDEPLT
     5,ISTD,JSTD,ILIT,JLIT,ILH,JLH,SEEDEP(6),NSEEDH ,NELEMS,JSTATE,JDAY
      COMMON/OTHER/ ATOT,ATOTO,SNODEP,SOILTE(5),PRECMM,WATER(5)
      COMMON/METEOR/EVAP,TDAY,TNIGHT,DAYWVP,DWINAV,DWINMX,DAPHOT,
     1 DAYRAD,DUST,DUSCUM(6),RAINCO(6),ERODE,DAYRUN,DDEPHI(6),DDEPOR(6)
     2 ,DDEPLT(5,6), DASNOW, DARAIN
      COMMON/TOTALS/CVEGV(10,6),CVEGO(15,6),CVEGVO(6),AVEGV(10),AVEGO(15
     1),AVEGVO,ABIOMA,CBIOMA(6),ALITT,CLITT(15),SEEDVM(6),ABIOSP(10),
     2TOT(6),POPSP(10),AVEG(15,10),ABIOM(30),ALIT(15),AORG(5),TOTAL(6),
     3ANIM(10,6),SVEG(10,10,6),SAVEG(10,10),SVEGO(10,6),SAVEGO(10)
     4 ,ASEED(10,6),ASEEDV(6),ASEEDH(10),ASEEDT,SEEDV(6,6),SEEDH(10,6),
     5 CORGM(6),AORGM, CMINM(6)
      COMMON/STAT/CVEG(15,10,6),SEED(10,6,6),POP(30),CBIOM(30,6),
     1 CLIT(15,6), CORG(5,6), CMIN(5,6), SNOCOV,WATABS(5),
     2 ANNCOV,PERCOV,TCOVER,COVER(10),FREWAT,
     3CDUM(50), SMIN(5,4), DUMBIO(11,6), CO2(15), FIXN2(5), DUMMY(144)
      COMMON /CHANGE/CVEGQQ(15,10,6),SEEDQQ(10,6,6),POPQQQ(30),
     1CBIOMQ(30,6),CLITQQ(15,6),CORGQQ(5,6),CMINQQ(5,6)
     2 ,SNOCOQ,WATABQ(5),               ANNCOQ,PERCOQ,TCOVQQ,COVERQ(10),
     3 FREWAQ, COUMQ1(50), SMINQQ(5,4), DUMBIQ(11,6), CO2QQQ(15),
     4 FIXN2Q(5), DUMMYQ(144)
C-
C-.........PARAMETERS THAT CAN BE VARIED BY SENSITIVITY SUBROUTINE
      COMMON/PARAM/ ADUM(8000),    AVINRT,CTRANS,DFAC,DMAXDN,DMAXUP,
     * EFAC,FRZWNS,FRZWS,FWMAX,IS,KSAT,NDH2SE,NTUWF,SBFAC,SMFAC,SMTEMP,
     * SM2RN,SNOMIN,SNOWAT,SNOWMM,STORM,SWRFAC,SWT1,SWT2,TFAC,VCOVER,
     * VHT,V2APCT,V2SPCT,COVFAC,RUNFAC,WERFAC,   ADUM2(37)
C..........ARR REMOVED,STORM NOW 8 IN SIZE NOT 5,ADUM2 ADDED 3-74 PWL
      COMMON/SUINIT/CI(5), AUTGRO, AUTNIT, SYMNIT(5), B1(5)
      COMMON/SUIDEC/EXTDEC, CBIO(11)  ,  NZONES
      COMMON/SUIENV/TEMP(7), PH(7), SS(7), WATPOT(7), TNC(6)
C-.........DIMENSION BELOW IS FOR ADDITION OF HANNA PARNAS NITRO
C-.........AND DECOMP SUBROUTINE
      DIMENSION  P(8,7),  S(8,7)
      REAL KSAT, LITMUV, LITLOS, NUTLOS
      LOGICAL FROZEN, WNDERO
C-
C-
C-----------------------------------------------------------------------
C-    INITIALIZATIONS, PRELIMINARY LOGICAL CHECKS
C-----------------------------------------------------------------------
C-.........'EVAP' IS SAVED SINCE IT IS NOT REASSIGNED A VALUE EACH TIME
C-.........UNIT AND IS DECREMENTED SEVERAL TIMES
      DAVAP=EVAP
C-----------------------------------------------------------------------
C-.........SE1 IS AVERAGE SALT CONCENTRATION AT SOIL SURFACE.   IT'S A
C-.........FAIRLY ROUGH MEASURE SINCE IT'S READ IN IN RAINCO(I) IN
C-.........EXOGEN AND HENCE CAN'T CHANGE EVENT BY EVENT.   ALSO, RUNON
C-.........IS NOT PRESENTLY ABLE TO AFFECT IT EITHER.    MMHOS/CM
C-.........THE KIND(S) OF SALT WHICH SOWAT CAN HANDLE WILL APPEAR IN
C-.........PLACE JSALT
      SE1=RAINCO(JSALT)
C-.........3-74 PWL
C-----------------------------------------------------------------------
C-.........SKIP ALL WATER CALCULATIONS IF THE PREVIOUS GENERAL TIME UNIT
C-.........IS BEING REPEATED IN ORDER TO SOLVE AN INCREMENT/DECREMENT
C-.........PROBLEM
      IF (IYRDAY .EQ. IOLDAY) GO TO 300
      RUNOFF=0.0
      ERODS=0.
      SNOMLT=0.0
      SNOVAP=0.0
      ET=0.0
      IF (IYRDAY.NE.ISEND(IS)) GO TO 100
      IS=IS+1
      IF (IS.GT.NS) IS=1
  100 IF (IEXDAY(IX) .NE.IDAY) GO TO 120
      IX=IX+1
C-*********************************************************************
      CALL EXOGEN
C-*********************************************************************
  120 IF (NAMDAY(INAM).NE.IDAY) GO TO 140
      GO TO 800
C-.........STATEMENT NUMBER 800 STARTS THE READING OF SOILS INPUT
C-.........VARIABLES. AFTER BEING READ CONTROL WILL COME BACK TO
C-.........STATEMENT NUMBER 121, BELOW.
  121 CONTINUE
      INAM=INAM+1
C-.........DETERMINATION OF FREEZING
  140 AVTEMP=(TDAY+TNIGHT)/2
      IF (SNODEP.GT.SNOMIN) GO TO 150
      FROZEN=.FALSE.
      IF (((AVTEMP.LE.FRZWNS).AND.(SNOCOV.LE.0.0)).OR.
     * ((AVTEMP.LE.FRZWS).AND.(SNODEP.LE.SNOMIN))) FROZEN=.TRUE.
  150 IF (DARAIN.LE.0.0) TINTER=0.0
C-.........DETERMINATION OF AVERAGE VEGETATION HEIGHT. TINTER IS TOTAL
C-.........INTERCEPTION FROM THE PRECEDING GENERAL TIME UNIT IF THERE
C-.........WAS ANY RAINFALL THEN
      IF(TINTER.GT.0.0) GO TO 180
      IF (NVC.LE.0) GO TO 170
      CTRANS(IS)=1.-(1.-ANNCOV)*(1.-PERCOV)
      VCOVER(IS)=TCOVER
      AVHT=0.0
      DO 160 I=1,NVC
      IV=IVC(I)
```

```
  160 IF((VHT(I).GT.FREWAT).AND.(COVER(IV).GT.0.001)) AVHT=AVHT+
     1       VHT(I)*COVER(IV)/TCOVER
      GO TO 180
  170 AVHT=AMAX1(0.0,(VHT(1)-FREWAT))
  180 TPPTN=DARAIN+FREWAT+DAYRUN/CONFAC
C--------------------------------------------------------------------
C-        STORM(IS) IS NOW THE AVERAGE RAINFALL RATE FOR SEASON IS
C-.........UNITS ARE MM/HR             3-74 PWL
      TRAIN=DARAIN/STORM(IS)
C--------------------------------------------------------------------
C-
C*******************************************************************
      CALL EVAPO(DARAIN,AVTEMP, IYRDAY, ET   , EOR, TRAIN, TCOVER)
C*******************************************************************
      EVAP=AMAX1(0.0,-EOR*240.)
C           EVAP IS DAILY RATE OF EVAPORATION, MM
C--------------------------------------------------------------------
C-    SNOW COVER DEPOSITION, BLOWING, MELTING, WATER RETENTION
C--------------------------------------------------------------------
      IF (SNOCOV.LE.0.0.AND.DASNOW.LE.0.0) GO TO 201
      DASNO=DASNOW
      TEMDFF=AVTEMP-SMTEMP(IS)
      IF (TEMDFF.LE.0.0) TEMDFF=0.0
      SNOMLT=SMFAC(IS)*TEMDFF
      IF (.NOT.FROZEN) SNOMLT=SNOMLT+SM2RN*TPPTN
      IF (SNOMLT.LE.0.0.AND.DASNOW.GT.0.0) DASNO=DASNO-SBFAC(IS)*DASNO
      IF (SNOMLT.GT.SNOWMM) SNOMLT=SNOWMM
      SNOCOQ=SNOCOQ+(DASNO-SNOMLT)*CONFAC
      SNOWMM=SNOWMM+(DASNO-SNOMLT)
      SNODEP=SC2SD*SNOWMM
      SNOVAP=AMIN1(EVAP,SNOMLT)
      EVAP=EVAP-SNOVAP
      SNOWAT=SNOWAT+TPPTN+SNOMLT-SNOVAP
      SWFREE=AMAX1(0.0,(SNOWAT-SWRFAC*SNOWMM))
      TPPTN=SWFREE
      FREWAT=TPPTN
      SNOWAT=SNOWAT-SWFREE
      H2OQQQ(KA)=H2OQQQ(KA)+(DARAIN+DASNO-SNOVAP)*CONFAC
  201 CONTINUE
      IF (TPPTN .LE. 0.0) GO TO 250
      TPPTN=FREWAT
      IF(SNOCOV .GT. 0.0 .OR. (DAYRUN + DARAIN) .LE. 0.0) GOTO 228
C-.........IF EXECUTION COMES TO THIS POINT AND DARAIN AND HENCE TRAIN
C-.........ARE ZERO, FIX UP RRATE TO AVOID CRASH.
      IF(TRAIN.LE.0.0)GOTO205
      RRATE = 1./TRAIN
      GOTO206
  205 RRATE=1.0
  206 CONTINUE
C--------------------------------------------------------------------
C-    INTERCEPTION AND CALCULATION OF WATER AVAILABLE FOR INFILTRATION
C--------------------------------------------------------------------
      RI=0.0
      IF (DARAIN.LE.0.0) GO TO 217
C-.........INTERCEPTION BELOW AND/OR ABOVE THE MINIMUM(AH2I)
      AH2I=AHFAC*AVHT*VCOVER(IS)
      BH2I=BHFAC*AVHT
      RAINV=VCOVER(IS)*DARAIN
      IF (TINTER.LE.AH2I) RI=AMIN1(RAINV,(AH2I-TINTER))
      IF ((RAINV-RI).GT.0.0) RI=RI+BH2I*(RAINV-RI)
      IF (RI.GT.RAINV) RI=RAINV
      TINTER=TINTER+RI
      REVAP=V2APCT*RI
      EVAP=AMAX1(0.0,(EVAP-REVAP))
      H2OQQQ(KA)=H2OQQQ(KA)+(DARAIN-REVAP)*CONFAC
C
C
  217 PPTN=RRATE*(DARAIN +DAYRUN/CONFAC - REVAP)*0.1
C           ASSUME DAYRUN OCCURS ONLY DURING RAIN 2-75 PWL
C           PPTN IS CM/HR OF WATER REACHING SOIL
C-.........GO THROUGH THIS LOOP HOUR BY HOUR UNTIL NO. HOURS .GE. TRAIN
      TIME = 0.0
  210 IF(TRAIN .LE. 0.0) GO TO 220
      ETIME = AMIN1(1., TRAIN)
      TIME = TIME + ETIME
      TRAIN = AMAX1(0., TRAIN - 1.)
      EOR = PPTN + FREWAT
C           CHANGE FROM MM TO CM.
      EOR=0.1*EOR
C-
C*******************************************************************
      CALL SOWAT( ET, RUNOFF, WATABS, WATER, SALNTY, EOR, SE1,
     1 ETIME,ETOUT,HROOT,SOILTE)
C*******************************************************************
C-
C           CHANGE BACK FROM CM TO MM
      RUNOFF=10.*RUNOFF
      ETOUT=10.*ETOUT
      FREWAT = AMIN1(FWMAX, RUNOFF)
      RUNOFF = RUNOFF - FREWAT
      ERODS = ERODS + RUNFAC*(EXP(RUNOFF/14.4) - 1.0)
      H2OQQQ(KA) = H2OQQQ(KA) - ETOUT*CONFAC    .
      H2OQQQ(KS) = H2OQQQ(KS) - RUNOFF*CONFAC
      ETOUT = 0.0
      GO TO 210
C-.........THIS IS FOR INFILTRATION OF ANY REMAINING FREE WATER AFTER
C-.........RAIN/RUNON
 220  ETIME = 24. - TIME
      IF(ETIME .GT. 0.0) GO TO 230
      GO TO 262
C-.........TREAT STANDING FREE WATER (AND/OR RAIN/RUNON ONTO  SNOW) AS
C-.........IF IT WERE A STEADY 24-HR RAIN  (WITH NO CHANCE FOR RUNOFF)
  228 ETIME = 24.
  230 EOR=0.1*FREWAT/ETIME
      GO TO 260
  250 ETIME = 24.
      EOR=-EVAP/240.
C-
C*******************************************************************
  260 CALL SOWAT( ET, RUNOFF, WATABS, WATER, SALNTY, EOR, SE1,
     1 ETIME,ETOUT,HROUT,SOILTE)
C*******************************************************************
C-
      RUNOFF=10.*RUNOFF
      ETOUT=10.*ETOUT
      FREWAT=AMIN1(FWMAX,RUNOFF)
      RUNOFF=RUNOFF-FREWAT
      ERODS=ERODS+RUNFAC*(EXP(RUNOFF/14.4)-1.0)
      H2OQQQ(KA)=H2OQQQ(KA)-ETOUT*CONFAC
      H2OQQQ(KS)=H2OQQQ(KS)-RUNOFF*CONFAC
      ETOUT=0.0
  262 H2OQQQ(KA) = H2OQQQ(KA) - ETOUT * CONFAC
C--------------------------------------------------------------------
C-    VAPOR LOSS FROM FREE WATER(DEPRESSION STORAGE)
C--------------------------------------------------------------------
      IF (FREWAT.LE.0.0) GO TO 282
      FREVAP=AMIN1[illegible]AT)
      EVAP=EVAP-FR[illegible]
      FREWAT=FREWAT-FREVAP
      H2OQQQ(KA)=H2OQQQ(KA)-FREVAP*CONFAC
C--------------------------------------------------------------------
C-.........ARTIFICIAL INPUT/OUTPUT. NOT TO EXCEED LIMITS
C--------------------------------------------------------------------
  282 IF ((FROZEN) .OR. NBC .LE. 0) GO TO 291
      DO 285 IH = 1, NHORIZ
      B = BC(IH)
      IF( (WATABS(IH) + BC(IH)).GT. WATGC(IH))   B= WATGC(IH) -
     1 WATABS(IH)
      IF ( (WATABS(IH) + BC(IH)) .LE. 0.0)  B = -WATABS(IH)
      WATABS(IH) = WATABS(IH) + B
  285 H2OQQQ(KG) = H2OQQQ(KG)  +B*CONFAC
  291 CONTINUE
      ST1 = AVTEMP
C-
C*******************************************************************
C-
      CALL DEGREE(IYRDAY, KK, K, SOILTE, ST1)
C*******************************************************************
C-
C--------------------------------------------------------------------
C-    DEPOSITIONS FROM THE ENVIRONMENT
C--------------------------------------------------------------------
  300 IF (DUST.LE.0.0) GO TO 302
C-.........CONTINUAL MINOR DUST BLOW-INS
      DO 301 J=1,NELEMS
      DUSTIN=DUSCOM(J)*DUST
      IG=IAG(J)
      CMINQQ(1,J)=CMINQQ(1,J)+DUSTIN
  301 AGAINQ(KA,IG)=AGAINQ(KA,IG)+DUSTIN
      ERODQQ(KA)=ERODQQ(KA)+DUST
  302 IF (ERODE .LE.0.0) GO TO 306
C-.........MAJOR WIND OR WATER DEPOSITION EVENTS
      ERODQQ(KS)=ERODQQ(KS)+ERODE
      DO 305 J=1,NFRELM
      IG=IAG(J)
      DO 304 IR=1,NDEPLT
      ILR=LITDEP(IR)
      CLITQQ(ILR,J)=CLITQQ(ILR,J)+DDEPLT(IR,J)
  304 AGAINQ(KS,IG)=AGAINQ(KS,IG)+DDEPLT(IR,J)
      CORGQQ(1,J)=CORGQQ(1,J)+DDEPOR(J)
      CMINQQ(1,J)=CMINQQ(1,J)+DDEPMI(J)
  305 AGAINQ(KS,IG)=AGAINQ(KS,IG)+DDEPOR(J)+DDEPMI(J)
  306 IF (DARAIN.LE.0.0) GO TO 308
C-.........RAIN-INS
      DO 307 J=1,NELEMS
      IG=IAG(J)
      RAININ=RAINCO(J)*DARAIN
      CMINQQ(1,J)=CMINQQ(1,J)+RAININ
  307 AGAINQ(KA,IG)=AGAINQ(KA,IG)+RAININ
C--------------------------------------------------------------------
C-    EROSION OF MATERIALS TO THE ENVIRONMENT
C--------------------------------------------------------------------
C-.........DETERMINE IF THERE IS WIND EROSION
  308 WNDERO=.TRUE.
      IF ((DWINAV+DWINMX).LE.0.0.OR.SNODEP.GE.SNOMXE) WNDERO=.FALSE.
      IR=KS
C-.........ADJUST POTENTIAL EROSION TO ACCOUNT FOR PLANT COVER
      IC=MINO((CTRANS(IS)*10.+1),10)
      ERODS=COVFAC(IC)*ERODS
C-.........BEGIN SERIES OF CALCULATIONS USED FOR BOTH TYPES OF EROSION
C-.........WITH WATER EROSION AS THE FIRST OPERATION
  310 IF (ERODS.LE.0.0.OR.FREWAT.GT.FWMAXE.OR.
     *          (IR.EQ.KS.AND.(FROZEN))) GO TO 370
C-.........DETERMINE WHAT MATERIALS CAN BE AFFECTED AND TOTAL WEIGHTS
      DO 315 I =1,NDEP
  315 IF (ERODS.LE.ERODED(I))  ID=I
      DO 316 IH=1,NHORIZ
  316 IF (DEPERO(ID).LE.HORDEP(IH)) NHE=IH
      TW=0.
      DO 325 IH=1,NHE
      HW=0.
      EROPCT(IH)=1.0
      IF (IH.EQ.NHE) EROPCT(IH)=
     *        (DEPERO(ID)-(HORDEP(IH)-HWIDTH(IH)))/HWIDTH(IH)
      DO 320 K=1,NELEM
  320 HW=HW+CORG(IH,K)+CMIN(IH,K)
      IL=ILH+IH
  325 TW=TW+(HW+AORG(IH)+CLITT(IL)+HORWT(IH))*EROPCT(IH)
      I=ILIT
      IF (IR.EQ.KA)   I=1
      DO 328 IL=I,JLIT
  328 TW=TW+CLITT(IL)
      PCTERO=ERODS/TW
C-.........ERODE NON-SOIL DETRITUS
      DO 340 IL=I,JLIT
      IF ((SNODEP.GT.0.0.OR.(FROZEN)).AND.(IL.GE.ILIT)) GO TO 341
      PCTLOS=AMIN1(1.0,(PCTERO*EMLIT(IL)))
      DO 335 IFE=1,NFRELM
      IF (CLIT(IL,IFE).LE.0.0) GO TO 335
      IG=IAG(IFE)
      LITLOS=CLIT(IL,IFE)*PCTLOS
      CLITQQ(IL,IFE)=CLITQQ(IL,IFE)-LITLOS
      AGAINQ(IR,IG)=AGAINQ(IR,IG)-LITLOS
  335 CONTINUE
  340 CONTINUE
  341 IF ((IR.EQ.KA).AND.(SNODEP.GT.0.0.OR.(FROZEN).OR.FREWAT.GT.0.0))
     *          GO TO 370
      IL=ILH
C-.........ERODE VARIOUS TYPES OF SOIL MATERIALS
      DO 360 IH=1,NHE
      PCTERD=EROPCT(IH)*PCTERO
      RUNLIT=AMIN1(1.0,(PCTERD*EMLIT(IL)*EMDIRT(IH)))
      RUNORG=AMIN1(1.0,(PCTERD*EMORG*EMDIRT(IH)))
      RUNNUT=AMIN1(1.0,(PCTERD*EMNUT*EMDIRT(IH)))
      DO 359 IFE=1,NFRELM
      LITLOS=0.0
      ORGLOS=0.0
      NUTLOS=0.0
      IF (SNODEP.GT.0.0) GO TO 355
      IF (CLIT(IL,IFE).LE.0.0) GO TO 354
      LITLOS=RUNLIT*CLIT(IL,IFE)
      CLITQQ(IL,IFE)=CLITQQ(IL,IFE)-LITLOS
  354 IF (CORG(IH,IFE).LE.0.0) GO TO 355
      ORGLOS=RUNORG*CORG(IH,IFE)
      CORGQQ(IH,IFE)=CORGQQ(IH,IFE)-ORGLOS
  355 IF ((CMIN(IH,IFE).LE.0.0).OR.(IFE.GT.NELEMS))GO TO 356
      NUTLOS=RUNNUT*CMIN(IH,IFE)
      CMINQQ(IH,IFE)=CMINQQ(IH,IFE)-NUTLOS
  356 IG=IAG(IFE)
      AGAINQ(IR,IG)=AGAINQ(IR,IG)-LITLOS-ORGLOS-NUTLOS
  359 CONTINUE
      ERODQQ(KS)=ERODQQ(KS)-EMDIRT(IH)*PCTERO*HORWT(IH)
      IL=IL+1
  360 CONTINUE
  370 IF (.NOT.(WNDERO)) GO TO 380
C-.........CALCULATE POTENTIAL AND ADJUSTED POTENTIAL FINE SAND WIND
C-.........EROSION. GO TO BEGINNING OF SERIES OF CALCULATIONS
      IR=KA
      HFAC=14.4*(1.+H2HFAC*VCOVER(IS)*AVHT)
      ERODS=    WERFAC*(EXP(DWINAV/HFAC)-1.)
      IF (NGUST(IS).GT.0)ERODS=ERODS+
     *        NGUST(IS)*GTU(IS)*WERFAC*(EXP(DWINMX/HFAC)-1.0)
      ERODS=COVFAC(IC)*ERODS
      WNDERO=.FALSE.
      GO TO 310
```

```
C-----------------------------------------------------------------------
C-     DETRITUS-TO-DETRITUS TRANSFORMATIONS
C-----------------------------------------------------------------------
  380 IF (NDIVLS.LE.0) GO TO 397
C-.........DO TRANSFORMATIONS FOR MULTIPLY-DIVIDED TYPES OF DETRITUS
      DO 396 L=1,NDIVLS
      DO 394 I=1,NLDIVS
      JL=L2LDIV(I,L)
C-.........JL IS ACCEPTOR TYPE
      IF (JL.LE.0) GO TO 396
      DO 394 K=1,NFRELM
      IF (CLIT(L,K).LE.0.0) GO TO 394
      LITMUV=RTLDIV(IS,I,L)*CLIT(L,K)
      CLITQQ(L,K)=CLITQQ(L,K)-LITMUV
      CLITQQ(JL,K)=CLITQQ(JL,K)+LITMUV
  394 CONTINUE
  396 CONTINUE
C-.........DO TRANSFORMATIONS FOR SINGLY-DIVIDED TYPES OF DETRITUS
  397 DO 399 L=L1,NOLIT
      JL=L2L(L)
C-.........JL IS ACCEPTOR TYPE
      IF (JL.LE.0) GO TO 399
      DO 398 K=1,NFRELM
      IF (CLIT(L,K).LE.0.0) GO TO 398
      LITMUV=CLIT(L,K)*RTL2L(L,IS)
      CLITQQ(L,K)=CLITQQ(L,K)-LITMUV
      CLITQQ(JL,K)=CLITQQ(JL,K)+LITMUV
  398 CONTINUE
  399 CONTINUE
C-----------------------------------------------------------------------
      DO 507 IH=1,NHORIZ
      WATPOT(IH)=  WATER(IH)
      TEMP(IH) = SOILTE(IH)
      PH(IH) = P(IS,IH)
      SS(IH) = S(IS,IH)
  507 TNC(IH) = SMIN(IH,2) + SMIN(IH,3) +SMIN(IH,4)
      TNC(NHORIZ +1)  =  TNC(NHORIZ)
      IF(NZONES .LE. NHORIZ)  GO TO 509
      DO 508 J = NHORIZ, NZONES
      WATPOT(J) = WATER(1)
      TEMP(J) = ST1
      PH(J) = P(IS,J)
  508 SS(J) = S(IS,J)
  509 CONTINUE
C-----------------------------------------------------------------------
C-     FUNGAL/ALGAL CRUST GROWTH
C-----------------------------------------------------------------------
C-.........CHECK FEASIBILITY OF CRUST GROWTH
  400 IF (FROZEN) GO TO 420
      IF (ICRS.LE.0.OR.FREWAT.GT.FWMAXC.OR.WATER(1).LE.POTDRY) GO TO 420
      DO 410 IFE=ISALT,JSALT
  410 IF (CMIN(1,IFE).LE.0.0) GO TO 420
      AUTGRO=ALIT(ICRS)*CPRATE(IS)
C-.........SET UP VECTOR C(IH) FOR NITRO
  420 IVO=IVH
      DO 550 IH=1,NHORIZ
      DO 546 I=1,NVNODS
      IV=IVNODS(I)
  546 CI(IH)=CI(IH)+AVEG(IV,IVO)
  550 IVO=IVO+1
C-     NITROGEN TRANSFORMATIONS
C-----------------------------------------------------------------------
C-.........EXECUTE THE NITROGEN TRANSFORMATIONS SUBROUTINE.
C-
C-*********************************************************************
      CALL NITRO
C-*********************************************************************
      IF(FROZEN) GO TO 520
      IF (ICRS.LE.0.OR.FREWAT.GT.FWMAXC.OR.WATER(1).LE.POTDRY) GO TO 520
C-.........PUT FUNGAL/ALGAL CRUST GROWTH(AUTOTROPHES IN PROPER CATEGOR.
C-.........CRUST CARBON ASSIMILATION
      DO 450 J=NFRAC1,NFRELM
      IG=IAG(J)
      CCGAIN= CFEPCT(J)*AUTGRO
      IF ( CLIT(ICRS,J).LE.0.0) GO TO 450
      CLITQQ(ICRS,J)=CLITQQ(ICRS,J)+CCGAIN
      AGAINQ(KA,IG)=AGAINQ(KA,IG)+CCGAIN
  450 CONTINUE
C-.........UPTAKE OF MINERALS BY CRUST
      DO 490 IES=ISALT,JSALT
      S2C=CFEPCT(IES)*AUTGRO
      IF ( CLIT(ICRS,IES).LE.0.0) GO TO 490
      CMINQQ(1,IES)=CMINQQ(1,IES)-S2C
      CLITQQ(ICRS,IES)=CLITQQ(ICRS,IES)+S2C
  490 CONTINUE
C-.........NITROGEN FIXATION BY CRUST
      IF  (CLIT(ICRS,IEN).LE.0.0) GO TO 510
      IG=IAG(IEN)
      CLITQQ(ICRS,IEN)=CLITQQ(ICRS,IEN)+AUTNIT
      AGAINQ(KA,IG) = AGAINQ(KA,IG) +AUTNIT
C-.........NITROGEN LOSSES TO ATMOSPHERE OF ALL NON-SOIL DETRITUS
  510 IG=IAG(IEN)
      IF (FROZEN) GO TO 600
      DO 520 L=1,JLIT
      IF (CLIT(L,IEN).LE.0.0) GO TO 520
      DNLOS = CLIT(L,IEN) * DNITL(L,IS) * HRTFAC(IS)
      CLITQQ(L,IEN)=CLITQQ(L,IEN)-DNLOS
      AGAINQ(KA,IG) =AGAINQ(KA,IG) -DNLOS
  520 CONTINUE
      DO 533 J=1,5
      DO 532 K=1,4
  532 CMINQQ(J,1)=CMINQQ(J,1)+SMINQQ( J,K)
  533 CONTINUE
      DO 535 I=1,6
      DO 534 J=1,11
      CLITQQ(MDUM,I)=CLITQQ(MDUM,I)+DUMBIQ(J,I)
  534 CONTINUE
  535 CONTINUE
C-----------------------------------------------------------------------
C-     DECOMPOSITION AND RESPIRATION IN DETRITUS AND SOIL ORGANIC MATTER
C-----------------------------------------------------------------------
C-
C-----------------------------------------------------------------------
  600 CALL DECOMP
C-----------------------------------------------------------------------
      DO 680 I=1,NFRELM
      DO 640 J=1,NMDUM
      IF (CLIT(MDUM,I).LE.0.0) GO TO 640
      CLITQQ(MDUM,I)=CLITQQ(MDUM,I)+DUMBIQ(J,I)
  640 CONTINUE
  680 CONTINUE

  700 DO 740 IH=1,NHORIZ
      DO 740 I=2,4
  740 CMINQQ(IH,I)=CMINQQ(IH,I)+SMINQQ(IH,I)

C-----------------------------------------------------------------------
C-     CALCULATION OF VARIABLES NOT IN 'STAT', 'TOTALS','OTHER', AND
C-     'ACC' TO BE PLOTTED VIA 'DUMMY'
C-----------------------------------------------------------------------
 1000 EVAP=DAVAP
      IF (IDUM.LE.0) GO TO 2000
C-.........VARIABLE 'IDUM' IN EFFECT POSITIONS THE WHOLE SEQUENCE OF
C-.........'DUMMY' SOIL VARIABLES IN THE 'DUMMY' ARRAY
      IH=0
      DO 1001 ID=IDUM,JDUM
      IH=IH+1
      DUMMY(ID)=PCTSAT(IH)
 1001 CONTINUE
      ID=JDUM+1
      DUMMYQ(ID)=DUMMYQ(ID)+DARAIN
      ID=ID+1
      DUMMYQ(ID)=DUMMYQ(ID)+RUNOFF
      ID=ID+1
C-.........RE-SET SNOW ACCUMULATOR TO SNOCOV VALUE ON DAY IDAYBS
      IF (IYRDAY.EQ.IDAYBS) DUMMY(ID)=SNOCOV
      DUMMYQ(ID)=DUMMYQ(ID)+DASNOW*CONFAC
      ID=ID+1
      DUMMY(ID)=SNOWAT
      ID=ID+1
      DUMMYQ(ID)=DUMMYQ(ID)+SNOMLT
      DO 1002 IH=1,NHORIZ
      ID=ID+1
C-.........WATER CONTENT AS FRACTION OF HORIZON WIDTH
      DUMMY(ID)=WATABS(IH)/HWIDTH(IH)
      ID=ID+1
      DUMMYQ(ID)=DUMMYQ(ID)+FLOWDN(IH)
      ID=ID+1
      DUMMYQ(ID)=DUMMYQ(ID)+FLOWUP(IH)
 1002 CONTINUE
C-.........DAY NUMBER RECORDER
 2000 IOLDAY=IYRDAY
C-----------------------------------------------------------------------
C-     DEBUGGING OUTPUT OF SOIL STATE AND OTHER VARIABLES WHEN NEEDED
C-----------------------------------------------------------------------
      IF (NDEBUG.EQ.0) RETURN
      WRITE (6,4999) IYRDAY
 4999 FORMAT ('0SOILS  DEBUGGING', 5X, 'IYRDAY =' I4)
      WRITE(6,3480) (WATER(IH),PCTSAT(IH),WATABS(IH),IH=1,NHORIZ)
 3480 FORMAT(' WATER=,PCTSAT=,WATABS=',15F8.2)
      WRITE (6,3468)  (H2OQQQ(I),ERODQQ(I),I=1,3)
 3468 FORMAT (' H2OQQQ AND ERODQQ  =', 12F17.4)
      WRITE (6,3485)((CLITQQ(I,J),I=1,NOLIT),J=1,NFRELM)
 3485 FORMAT (' CLITQQ =', 10F12.2)
      WRITE (6,3444)((CORQQQ(IH,J),IH=1,NHORIZ),J=1,NFRELM)
 3444 FORMAT(' CORQQQ =', 10F12.2)
      WRITE (6,3483)((CMINQQ(IH,J),IH=1,NHORIZ),J=1,NFRELM)
 3483 FORMAT (' CMINQQ =', 10F12.2)
      WRITE(6,3448)((SMINQQ(IH,N),IH=1,NHORIZ),N=1,4)
 3448 FORMAT(' SMINQQ=',10F12.2)
      WRITE (6,3469) ((AGAINQ(I,J),I=1,3),J=1,NFRAC1)
 3469 FORMAT (' AGAINQ =', 10F12.2)
C-.........RETURN CONTROL TO THE MAIN CALLING PROGRAM
      RETURN
C-----------------------------------------------------------------------
C-     ENTRY POINT FOR READING IN NAMELIST BY CALLING PROGRAM INITIALLY
C-----------------------------------------------------------------------
      ENTRY SINPUT
C-*********************************************************************
C-*********************************************************************
C-.........DEFAULT VALUES FOR CERTAIN VARIABLES
C-.........ON BURROUGHS CAN'T USE DATA STATEMENT TO INITIALIZE COMMON
C-.........ELEMENT IN SUBPROGRAM. . SO FOLLOWING CARDS REPLACE A
C-.........DATA DECLARATION
      IX=1
      INAM=1
      MTU=24
      TINTER=0.
      NBC=0
      FROZEN=.FALSE.
      SNOWMM=0.
      IOLDAY=-5
      CONFAC=1.E+07
      DO 92 NNNNN=1,8
      TFAC(NNNNN)=1.
   92 EFAC(NNNNN)=1.
C-.....END REPLACEMENT OF DATA STMT. 1-74 PWL
C-*********************************************************************
C-.........FORMATTED INPUT ADDED 1-74, PAUL LOMMEN
C-.........READ IN SOILS VARIABLES
C-.........RCHECK(I) IS FOR COMMENTS AND READ CHECK (I=1,20,  A4 )
C-
C-.........ST. NO. 800 IS STUCK IN HERE SO INPUT VARIABLES FOR SOILS
C-.........CAN BE READ ACCAORDING TO NAMDAY(INAM) IF DESIRED
  800 CONTINUE
      READ(5,801)   RCHECK
      WRITE(6,802)  RCHECK
C-.........READ IN SCALARS FIRST
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,803) AWFAC, BWFAC, EMNUT, EMORG, FRZWNS, FRZWS, FWMAX,
     1 FWMAXC, FWMAXE, H2WFAC
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,804) ICF, ICRS, IDAYBS, IDUM, IEN, IFF, INAM, IS, ISALT,
     * ISF, ITUWF, IVH, IX, JDUM, JSALT, JVH, KA, KG, KS, L1, MTU,
     * NDEP, NDIVLS, NLDIVS, NS, NSTORM, NTUWF, NVC, NVNODS, NVR
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,803) POTDRY, POTWET, RUNFAC, SC2SD, SM2RN, SNOMIN,
     1 SNOMXE, SNOWAT, SWRFAC, V2APCT
      READ(5,805) WERFAC
C-.........NOW READ IN VECTORS(OR SINGLY DIMENSIONED ARRAYS)
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,801)   RCHECK
      WRITE(6,802)RCHECK
      READ(5,810)AVINRT,BC,CFEPCT,COVFAC,CPRATE,CTRANS,DEPERO,DFAC
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,811)EFAC, EMDIRT, EMLIT, ERODED, GTU, HORWT, HRTFAC,
     1 HWIDTH, IAG, IEXDAY
      READ(5,801)   RCHECK
      WRITE(6,802)RCHECK
      READ(5,812) ISEND, IVC, IVNODS, KSAT, L2L,NAMDAY, NGUST, SBFAC,
     1 SFLOW, SMFAC
      READ(5,801)   RCHECK
      WRITE(6,802)RCHECK
      READ(5,813)SMTEMP,STORM,TFAC,VCOVER,VHT,WATER,WATGC
C-.........FINALLY READ IN THE ARRAYS
      READ(5,801) RCHECK
      WRITE(6,802)  RCHECK
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,803)((DNITL(I,J), J=1,8), I=1,15)
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,817) L2LDIV
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,803) RUF
      READ(5,801) RCHECK
```

```
      WRITE(6,802)RCHECK
      READ(5,803) RTLDIV
      READ(5,801) RCHECK
      WRITE(6,802)RCHECK
      READ(5,803)((RTL2L(I,J),J=1,8), I=1,15)
      READ(5,801)   RCHECK
      WRITE(6,802)  RCHECK
  801 FORMAT(20A4)
  802 FORMAT(' ',5X,20A4)
  803 FORMAT(8F10.5)
  804 FORMAT(16I5)
  805 FORMAT(8E10.3)
  810 FORMAT(10F8.4/,5F10.5/,6F10.5/, 10F8.4/, 2(8F10.5/),6F10.5/,
     * 5F10.5)
  811 FORMAT(8F10.5/, 5F10.5/, 8F10.5/, 7F10.5/, 6E10.3/, 8F10.5/,
     * 5E10.3/, 8F10.5/, 5F10.5/, 6I5/,5I5)
  812 FORMAT(8I5/, 10I5/, 5I5/, 5F10.5/, 15I5/, 5I5/, 8I5/, 8F10.5/,
     * 6F10.5/, 8F10.5)
  813 FORMAT(4(8F10.5,/),10F8.4,/,5F10.5,/,5F10.5)
  815 FORMAT(15I5)
  816 FORMAT(5F10.5)
  817 FORMAT(3I5)
C-.........THE NEXT IF STATEMENT IS THERE IN CASE SOILS VARIABLES
C-.........HAVE JUST BEEN READ ACCORDING TO NAMDAY(INAM)
C-.........THIS IS OF COURSE NOT NEEDED WITH NAMELIST
      IF(NAMDAY(INAM) .EQ. IDAY) GO TO 121
C-.........END FORMATTED INPUT FOR SOILS 3.5 ADDED 1-74
C-*********************************************************************
C..........2-75 PWL  INITIALIZE HROOT TO ANYTHING OTHER THAN ZERO.
      HROOT=-1000.
C-
C-.........HERE ARE A FEW VARIABLES NEEDED TO RUN NITRO AND DECOMP
      READ(5,801)   RCHECK
      WRITE(6,802)  RCHECK
      READ(5,820) P,S,SMIN,MDUM,NZONES
  890 FORMAT(7(8F10.3/), 7(8F10.4/), 4(5F10.4/), 2I2)
C-.........END READING VARIABLES FOR NITRO,DECOMP
C..........THIS IS FOR SUBROUTINE DEGREE
      K=NHORIZ
      KK=K+1
C*********************************************************************
      CALL ENTEVA
      CALL ENTWAT
      CALL ENTDEG
      CALL SNINM
      CALL SNIN
C-.........RETURN CONTROL TO THE MAIN CALLING PROGRAM
      RETURN
      END
```

Subroutine DEGREE

```
$SET SEPARATE
$RESET FREE
$SET STACK
$SET OWN
      SUBROUTINE DEGREE(IYRDAY,KK,K,SOILTE,ST1)
C     THIS PROGRAM IS PART OF DESERT BIOME MODEL SOILS IV
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975      PAUL W. LOMMEN
C-*********************************************************************
      DIMENSION RCHECK(20)
      DIMENSION F(6),E(6),STEMP(6),CV(6),DD(6),CONDUC(6),SOILTE(5)
      DIMENSION BEGTEM(6),DEG(366)
      STEMP(1)=ST1
      STEMP(KK)=BEGTEM(KK)
      IF (NDEG.GT.0) STEMP(1)=DEG(IYRDAY)
C-*********************************************************************
C-       SOLUTION TO TRI-DIAGONAL MATRIX
C-*********************************************************************
      DO 46 I=2,K
      POT=(DD(I+1)-DD(I-1))/(2.*DTIME)
      DLXA=(DD(I)-DD(I-1))
      DLXB=(DD(I+1)-DD(I))
      BB=CV(I)*POT+CONDUC(I)/DLXB+CONDUC(I-1)/DLXA
      DA=CV(I)*POT*BEGTEM(I)
      IF (I .GT. 2) GO TO 44
      DA=DA+CONDUC(I-1)*STEMP(I-1)/DLXA
      F(I)=DA/BB
      E(I)=(CONDUC(I)/DLXB)/BB
      GO TO 46
   44 IF (I .GE. K) GO TO 47
   45 E(I)=(CONDUC(I)/DLXB)/(BB-(CONDUC(I-1)/DLXA)*E(I-1))
      F(I)=(DA+(CONDUC(I-1)/DLXA)*F(I-1))/(BB-(CONDUC(I-1)/DLXA)*E(I-1))
   46 CONTINUE
   47 BB=BB-CONDUC(I)/DLXB
      STEMP(I)=(DA+(CONDUC(I-1)/DLXA)*F(I-1))/(BB-(CONDUC(I-1)/DLXA)*
     1E(I-1))
   48 I=I-1
      STEMP(I)=E(I)*STEMP(I+1)+F(I)
      IF (I .GT. 2) GO TO 48
      STEMP(KK)=(BEGTEM(KK)+STEMP(K))*0.5
C-*********************************************************************
      DO 50 I=1,KK
      BEGTEM(I)=STEMP(I)
   50 CONTINUE
      DO 60 I=1,K
   60 SOILTE(I)=(STEMP(I)+STEMP(I+1))*0.5
      RETURN
C-*********************************************************************
      ENTRY ENTDEG
C---------------------------------------------------------------------
C-.........NAMELIST TEMPIN REPLACED BY FORMATTED INPUT 1-74 PAUL LOMMEN
      READ(5,801)RCHECK
      WRITE(6,802)RCHECK
      READ(5,101)BEGTEM,CV,CONDUC,DTIME,DEG,NDEG,DD
C-.........THIS IS THE THIRD PLACE HORIZON DEPTHS ARE READ IN!
  101 FORMAT(6F10.2/, 6F10.3/, 6F10.5/, F10.5/, 30(12F6.2/), 6F6.2/,
     1 I5/, 6F10.5)
  801 FORMAT (20A4)
  802 FORMAT (' ',5X,20A4)
C-.........END NAMELIST REPLACEMENT
      RETURN
      END
```

Subroutine EVAPO

```
$SET SEPARATE
$RESET FREE
$SET STACK
$SET OWN
      SUBROUTINE EVAPO(DARAIN,AVTEMP,IYRDAY,ET,EVAP,TRAIN,COVER)
C     THIS PROGRAM IS PART OF DESERT BIOME MODEL SOILS IV
C     RUN ON BURROUGHS 6700 AT UTAH STATE UNIVERSITY
C     APRIL 1975      PAUL W. LOMMEN
C-*********************************************************************
      DIMENSION RCHECK(20)
      DIMENSION PLACE(20), DALITE(366), FACTOR(4), T(4)
      REAL LAT
      LOGICAL AVCENT
C-*********************************************************************
C-       FACTOR IS BLANEY-CRIDDLE CROP FACTOR
      IF (AVCENT) TEMP=(AVTEMP*1.8)+32.
      IF(.NOT. AVCENT) TEMP = AVTEMP
      IF (DARAIN.GT.0.0) GO TO 20
      DO 10 I=1,NT
      J=I
   10 IF (TEMP.LT. T(I)) GO TO 15
   15 ET=-(DALITE(IYRDAY)*TEMP*FACTOR(J))*2.54/24.
      EVAP=ET*(1.-COVER)
      RETURN
   20 ET=0.0
      EVAP=DARAIN*0.1/TRAIN
      RETURN
C-*********************************************************************
      ENTRY ENTEVA
C---------------------------------------------------------------------
C-.........NAMELIST EVAPIN REPLACED BY FORMATTED INPUT 1-74,PAUL LOMMEN
      READ(5,801)RCHECK
      WRITE(6,802)  RCHECK
      READ(5,101) PLACE,LAT,DALITE,FACTOR,T,NT,AVCENT
  101 FORMAT(20A4/, F10.6/, 30(12F6.2/),6F6.2/,4F10.5/,4F10.6/,I5/,L4)
  801 FORMAT (20A4)
  802 FORMAT (' ',5X,20A4)
C-.........END NAMELIST REPLACEMENT
C---------------------------------------------------------------------
      IF (DALITE(1).GT.0.0) RETURN
      DO 1 I=1,365
      A=730.-.274*LAT+.00793*(LAT**2)
      B=34.2-.78*LAT+.1*(LAT**2)
      Z=2.*3.1416*((I+285.)/365.)
      DALITE(I)=A+B*SIN(Z)
      TOTMIN=DALITE(I)+TOTMIN
    1 CONTINUE
      DO 7 I=1,365
      DALITE(I)=DALITE(I)/TOTMIN
    7 CONTINUE
      RETURN
      END
```

Subroutine OPT

```
$SET SEPARATE
$RESET FREE
      SUBROUTINE OPT(AMIN1,AMAX1,AMAX2,AMIN2,RX,FR)
      IF(RX.LE.AMIN1.OR.RX.GE.AMIN2)GO TO 110
      IF(RX.GE.AMAX1.AND.RX.LE.AMAX2)GO TO 101
      IF(RX.GT.AMIN1.AND.RX.LT.AMAX1)GO TO 102
      IF(RX.GT.AMAX2.AND.RX.LT.AMIN2)GO TO 103
  110 FR=0.0
      GO TO 104
  101 FR=1.0
      GO TO 104
  102 FR=(RX-AMIN1)/(AMAX1-AMIN1)
      GO TO 104
  103 FR=(RX-AMAX2)/(AMIN2-AMAX2)
  104 RETURN
      END
```

Subroutine RAMP

```
      SUBROUTINE RAMP(AMINX,AMAXX,RX,FRAC)
      IF(RX.GE.AMAXX)GO TO 1
      IF(RX.LE.AMINX)GO TO 2
      FRAC=(RX-AMINX)/(AMAXX-AMINX)
      GO TO 3
    1 FRAC=1.0
      GO TO 3
    2 FRAC=0.0
    3 RETURN
      END
```

Subroutine DCLIN

```
      SUBROUTINE DCLIN(AMAXX,RX,FRAC)
      MX=AMAXX
      IF(MX.EQ.0)GO TO 302
      IF(RX.GE.AMAXX)GO TO 300
      FRAC=1.0-RX/AMAXX
      GO TO 301
  300 FRAC=0.0
      GO TO 301
  302 FRAC=1.0
  301 RETURN
      END
```