General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

Produced by the NASA Center for Aerospace Information (CASI)

9950-997

(NASA-CR-175455) VEGETATION ANALYSIS FOR ARID LANDS GEOBOTANY Final Report (California Univ.) 35 p HC A03/MF A01 CSCL 08B

N85-19500

Unclas

G3/43 14307

Final Report

Vegetation Analysis for Arid Lands Geobotany

Michael G. Barbour, Principal Investigator

Susan L. Ustin, Research Associate

4 MAR 1985
RECEIVED
NASA STI FACILITY
ACCESS DEPT.

Contract # 956982
Jet Propulsion Laboratory
Pasadena, CA 91109

Department of Botany
University of California
Davis, CA 95616

This report was prepared for the Jet Propulsion Laboratory, California Institute of Technology, sponsored by the National Aeronautics and Space Administration.

I. Site selection

Three primary study sites were selected for measurement of plant phenological properties and spectral analysis. The sites selected represented typical sagebrush, creosote bush and saltbush communities in Owens Valley. They were located close to man-made features for identification on remotely sensed images but showed little evidence of recent disturbance.

The saltbush site, located near Dirty Socks springs at the southern end of Owens Lake, is at 4,000 ft. elevation. This site, actually two subsites located about 2 miles apart, is representative of the saltbush flora commonly found in saline or alkaline areas. We identified for study five species which were the most abundant species and which exhibited contrasting leaf morphologies of potential spectral interest. The morphological characteristics of these species were matched with species having similar or contrasting morphologies at the other sites. It was hoped this would allow some preliminary assessment of the significance of these features in remotely sensed data.

The other study sites are located on Sierran fans at 4,500 ft. The creosote bush site, west of Cartago, CA, represents the northernmost extreme of this vegetation type, in the transition zone between Mojave and Great Basin floras. While most members of this community are typical of the Mojave province (although the sagebrush along the stream channel is not), the low abundance of creosote bush is somewhat anomalous compared to more centrally located stands in its range. The presence of sagebrush at this site is obviously influenced by the stream; however, it allows an opportunity for us to determine if its presence can be identified in remotely sensed data. The abundance of Haplopappus Cooperi and Chrysothamnus teretifolius at both fan localities permits further such comparisons between sites.

The sagebrush site is located west of Independence, CA within the upper fan zone which includes Purshia and Coleogyne. This vegetation type is extensive at this elevation within the valley and is the most common type represented on the numerous burns north and south of Independence. (Many of these fires were intentionally set by ranchers to remove Coleogyne from range land.) This site gave us an opportunity to compare phenological status as well as a control locality for comparisons between cover and species composition in assessment of revegetation and associated spectral changes after fire.

In addition to the primary study localities we have been measuring cover and species composition at five different aged burns. Four of these have been on granitic alluvium and one on a volcanic substrate having a very different albedo.

Selection of these sites has permitted us to make phenological and morphological comparisons that will be used in subsequent analysis and modeling of spectral characteristics within and between the three vegetation types.

II. Soil analysis

Arrangements have been made with Mr. Fred Fischer of the Soil Conservation Service, in Bishop, CA, to map our soils. The service will do a complete map, including a textural and chemical analysis. In the fall we have arranged to rent a back-hoe so that they can map the soil profile through the root zone. We will use this opportunity to examine the root distribution of the study species through the soil profile. This information will be used in interpreting and modeling shoot water content and water movement from the soil.

III. Collection of leaf and plant samples

In May, leaf samples of all species were collected, fixed in gluteraldehyde, and returned to U.C.D. for analysis. Dr. Leslie Sunell, Dept. of Botany, is characterizing the morphological characteristics of each leaf type, using SEM techniques. Samples will be analysed later for elemental composition using the x-ray microprobe. This technique, if successful, will be useful in determining the presence and location of inorganic ions within foliar tissue.

Four to five plants of each species have been transplanted into 6 inch containers and returned to greenhouses at U.C.D. or the U.C. White Mt. Field Station. It was necessary to collect these plants now for analysis of photosynthetic and water relations properties next winter because of the long time they require to become established.

IV. Results of Phenological Studies

Several phenological characteristics were chosen for measurement. These included: leader length; % of buds on branches; bud, flower, and fruit class; % of canopy green and % cover; and % of leaf senescence. Plant size was also measured. Although the phenological studies are not completed, several interesting trends have emerged. Spring growth and leaf senescence began earliest in the creosote bush community, last in the saltbush community. Most rapid growth began in late March at all sites. There are differences between species at all sites, although they appear to be relatively subtle and may not be detectable by remotely sensed data. However, the timing of leaf senescence may be more readily observed. There are more obvious differences between sites and species in this regard. Growth had slowed for most species by June, with the exception of species in the saltbush community. Flowering of some species can be expected to alter their spectral responses. This data will be used to aid interpretation of seasonal patterns in spectral characteristics. Summaries of the phenological data are included in Appendix A. Data for each species is presented covering the 1984 growing season. Column headings indicate the following:

1. "Days" = Number of days since February 25, 1984
2. "%brown" = Mean percentage of plant surface that was brown (n=10) on each sample day
3. "%cover' = Mean percentage of ground surface covered by plant (n=10) on each sample day
4. "leadr,mm" Mean length of leader growth (n=10 leaders from 10

shrubs)

Plot headings are indicated:

1. On multiple plots, "A" = "%brown", "B" = "%cover"
2. Single plots indicate "leader length"
3. Days are always indicated on the x-axis.

Data for the following species are included:

1. Sagebrush site
   a. _Artemesia tridentata_
   b. _Chrysothamnus teretifolius_
   c. _Coleogyne ramosissima_
   d. _Eriogonum fasiculatum_
   e. _Purshia glandulosa_

2. Creosote bush site
   a. _Artemesia tridentata_
   b. _Encelia virginensis_
   c. _Grayia spinosa_
   d. _Franseria dumosa_
   e. _Larrea divaricata_

3. Saltbush site

   a. _Atriplex canescens_
   b. _Atriplex Parryi_
   c. _Distichlis spicata_
   d. _Sarcobatus vermiculatus_
   e. _Suaeda ramosissima_

V. Results of Vegetation Analysis

Community composition has been studied at these three sites plus five burned sites. Ten 50 m transects at each locality have been measured for percent cover (over 10 cm) by species. On each transect we have conducted 2 point quarter and 5 nearest neighbor analyses. These data gave us % cover, cover by area, plant size, tendency for association, and recolonization patterns after a disturbance. These data will be used for assessment of changes in species composition and plant density on spectral response. These data are also necessary for predictive analyses and modeling of the spectral responses of vegetation. Percentage plant cover is shown in Appendex B for six sites. The column headings indicate the following:

Col. # 1. "symburn" = Symmes Creek, burned area
2. "symoffb" = Symmes Creek, non-burned area
3. "sagoffb" = Onion Valley Road, non-burned area
4. "sageburn"= Onion Valley Road, burned area
5. "Divcrofb"= Division Creek, non-burned area, granite soil
6. "Creosofb"= Creosote bush site, non-burned area
7. "Saltbush"= Saltbush site, non-burned area

Analysis of variance is shown for the following pairs:

1. Symmes Creek burned and non-burned areas ($P < .001$)
2. Symmes Creek non-burned and Onion Valley non-burned (NS)
3. Onion Valley burned and non-burned areas ($P < .005$)
4. Onion Valley non-burned and Division Creek non-burned (NS)
5. Symmes Creek burn and Onion Valley burn ($P < .025$)

VI. Summary of selected phenological data

These data summarize the phenological studies conducted this growing season. They will be published in an appropriate journal with the spectral data obtained in the Arid Lands Geobotany project.

MTB > PRINT C1-C4 *Artemesia tridentata, sagebrush site*

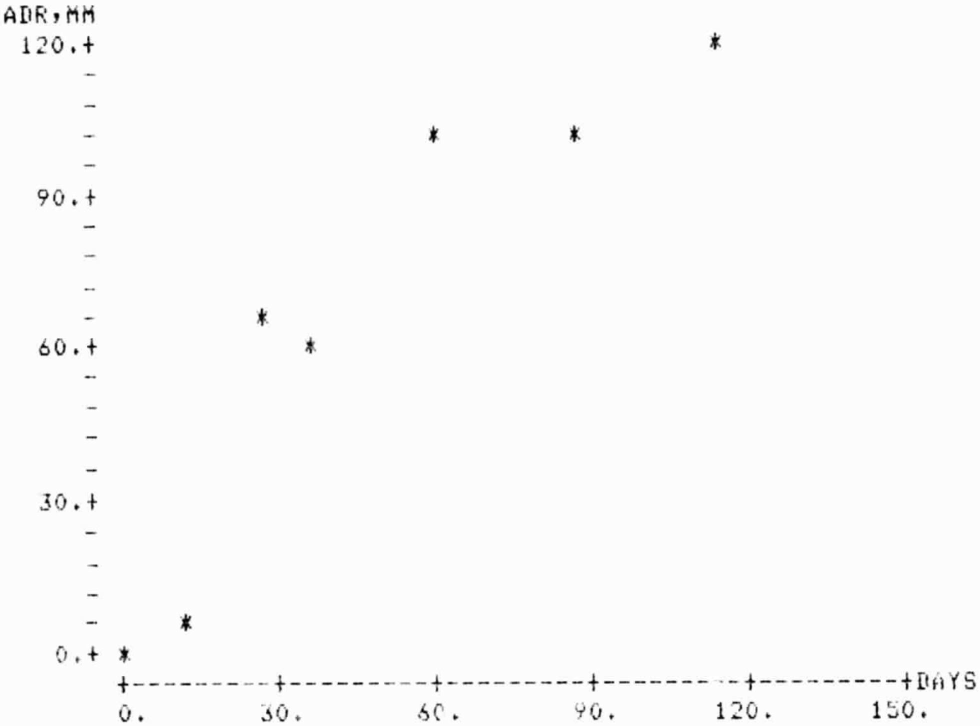
ROW	%BROWN	%COVER	LEADR,MM	DAYS
1	0.405	0.815	0.0	1
2	0.385	0.815	3.3	12
3	0.340	0.840	64.8	26
4	0.260	0.934	60.8	37
5	0.255	0.875	100.7	61
6	0.260	0.855	100.9	86
7	0.410	0.805	119.1	115

```
MTB > MPLOT C1 VS C4 C2 VS C4
   %BROWN
    1.00+
        -
        -            B
        -
        -                    B
    0.85+         B                   B
        - B   B                                B
        -
        -
        -
    0.70+
        -
        -
        -
        -
    0.55+
        -
        -
        -
        -
    0.40+ A   A                                A
        -
        -         A
        -
        -
    0.25+            A       A        A
          +---------+---------+---------+---------+---------+DAYS
          0.       30.       60.       90.      120.      150.

MTB > PLOT C3 VS C4
  LEADR,MM
    120.+                                      *
        -
        -
        -                    *        *
        -
     90.+
        -
```

FOLDOUT FRAME

0. 30. 60. 90. 120. 150.

MTB > PLOT C3 VS C4



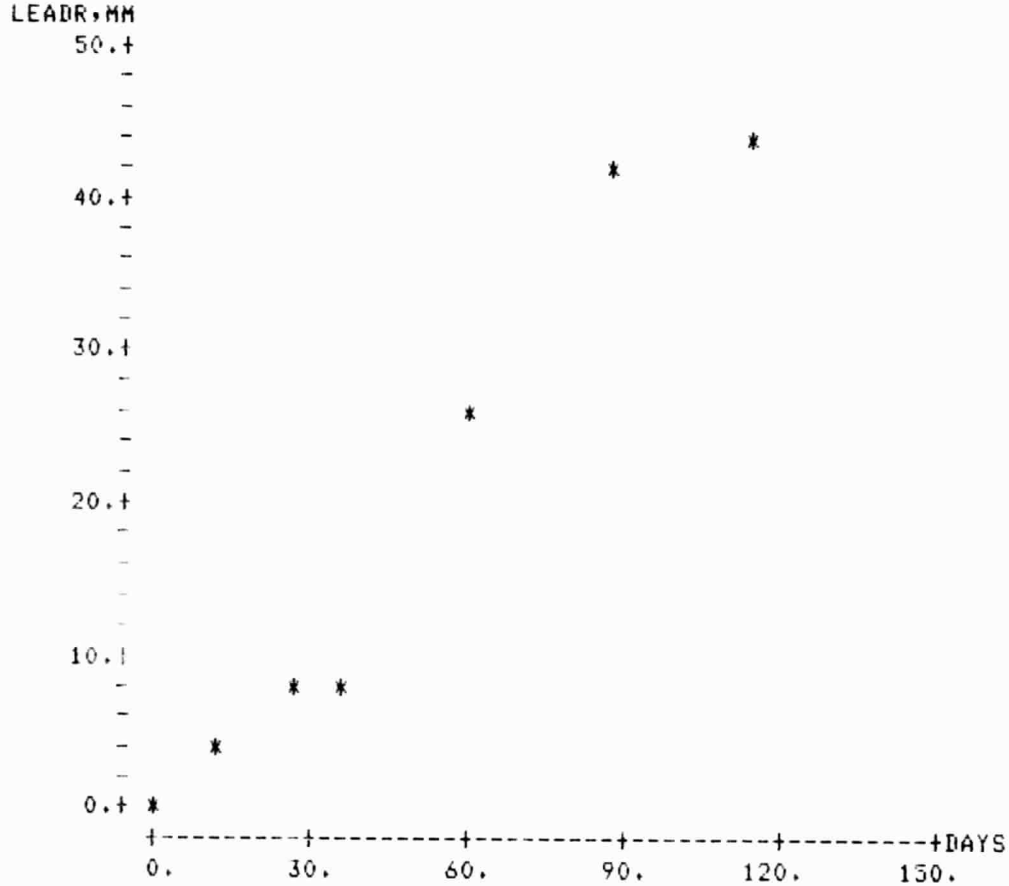
MTB > STOP

2 FOLDOUT

```
MTB > PRINT C1 C3 C4 C5 Chrysothamnus teretifolius
 ROW    DAYS  %BROWN   %COVER  LEADR,MM

   1       1   0.665    0.930      0.00
   2      12   0.660    0.920      3.49
   3      26   0.545    0.904      7.39
   4      37   0.255    0.770      8.33
   5      61   0.475    0.929     25.15
   6      86   0.675    0.890     41.00
   7     115   0.575    0.850     43.90

MTB > MPLOT C3 VS C1 C4 VS C1
          %BROWN
           1.00+
               -
               - B                   B
               -     B     B
               -                               B
           0.85+                                          B
               -
               -
               -              B
               -
           0.70+
               - A    A                        A
               -
               -
               -
               -                                          A
           0.55+            A
               -
               -                    A
               -
               -
           0.40+
               -
               -
               -
               -
           0.25+               A
                 +---------+---------+---------+---------+---------+DAYS
                 0.       30.       60.       90.      120.      150.

MTB > PLOT C5 VS C1
        LEADR,MM
           50.+
              -
              -
              -                                           *
              -                                *
           40.+
              -
              -
```

FOLDOUT FRAME

MTB > PLOT C5 VS C1



MTB > STOP

2 FOLDOUT FRAME

MTB > PRINT C1 C4 C5 C14 *Coleogyne ramosissima*

ROW	DAYS	%BROWN	%COVER	LEADR,MM
1	1	0.946	0.945	0.0
2	12	0.900	0.945	3.8
3	26	0.805	0.938	43.8
4	37	0.625	0.830	37.5
5	61	0.470	0.925	20.1
6	86	0.595	0.930	35.2
7	115	0.495	0.913	41.0
8	*	*	*	*
9	*	*	*	*
10	*	*	*	*

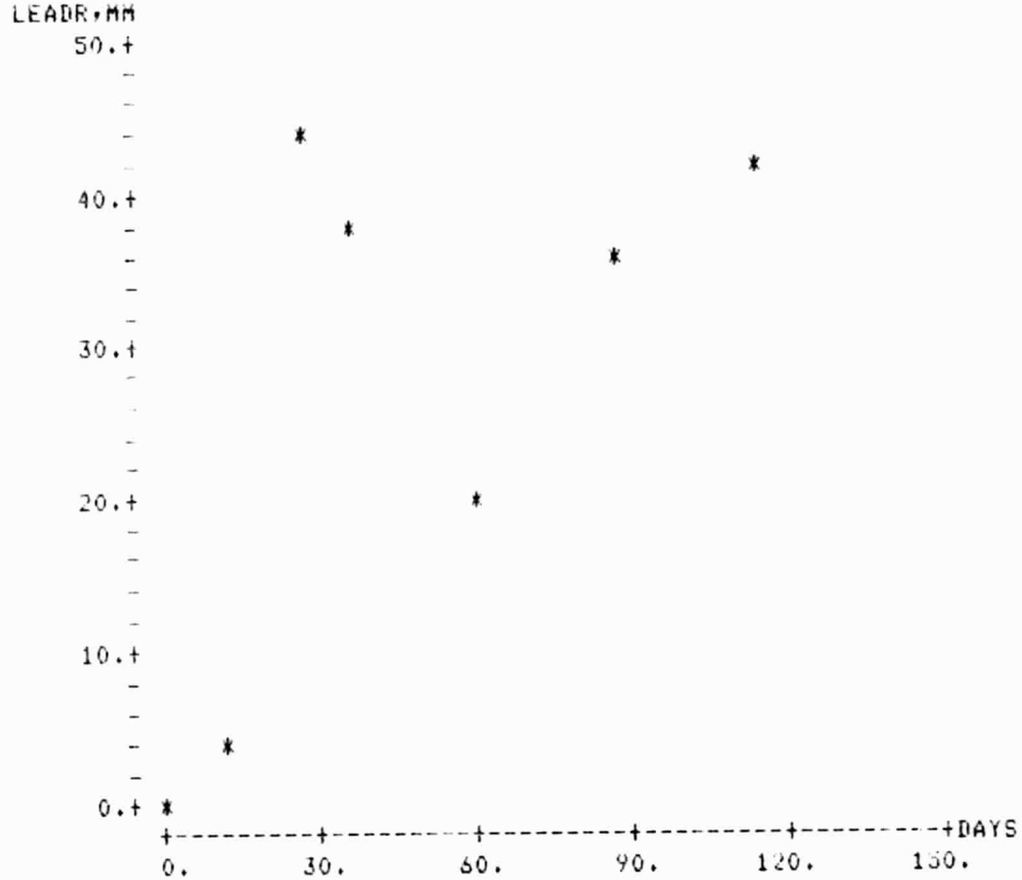
```
MTB > MPLOT C4 VS C1 C5 VS C1
         %BROWN
          0.95+ 2   B
              -          B          B        B
              -     A                                 B
              -
              -
          0.85+
              -             B
              -          A
              -
              -
          0.75+
              -
              -
              -
              -
          0.65+
              -             A
              -
              -                                A
              -
          0.55+
              -
              -
              -                                         A
              -                      A
          0.45+
                +---------+---------+---------+---------+---------+DAYS
                0.       30.       60.       90.      120.      150.

   6 MISSING OBSERVATIONS

MTB > PLOT C14 C1
       LEADR,MM
           50.+
              -
              -
```

FOLDOUT FRAME

```
+---------+---------+---------+---------+---------+DAYS
0.       30.       60.       90.      120.      150.
```

6 MISSING OBSERVATIONS

```
MTB > PLOT C14 C1
```



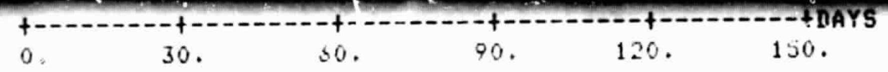
3 MISSING OBSERVATIONS

```
MTB > STOP
```

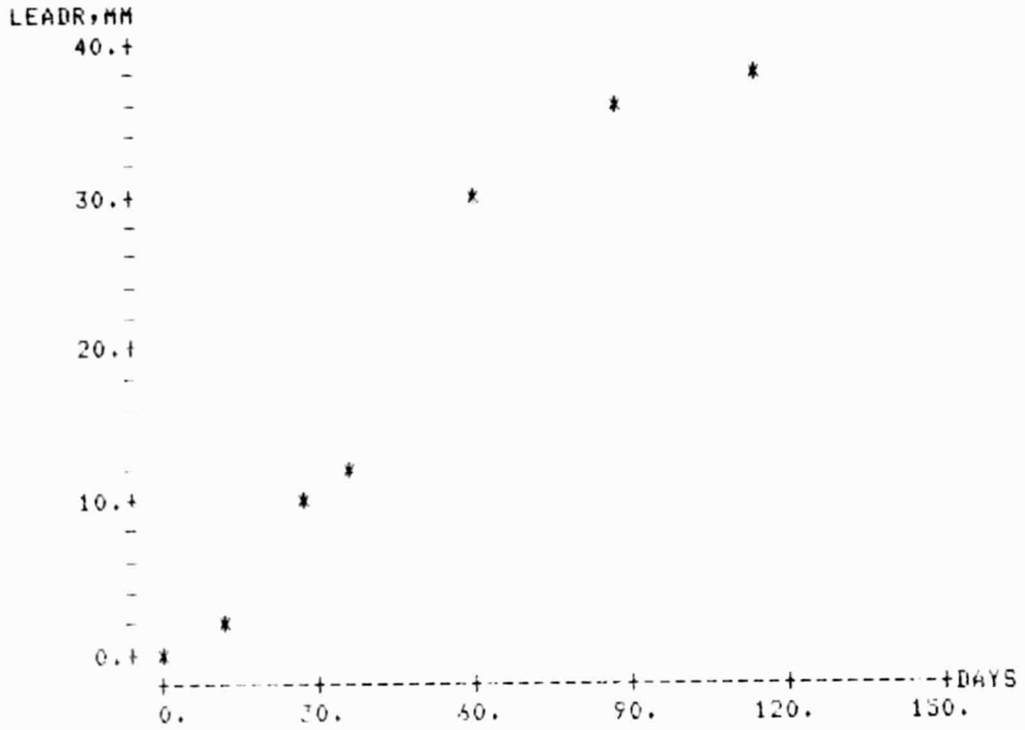
2 FOLDOUT FRAME

```
MTB > PRINT C1 C3 C4 C7   Eriogonum fasciculatum
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1   0.985   0.940      0.00
   2     12   0.817   0.970      2.41
   3     26   0.510   0.962      9.26
   4     37   0.460   0.924     12.43
   5     61   0.210   0.961     29.30
   6     86   0.125   0.966     36.59
   7    115   0.265   0.927     38.20

MTB > MPLOT C3 VS C1 C4 VS C1
          %BROWN
           1.00+ A
               - B   B   B          B        B
               -            B                        B
               -
               -
           0.80+     A
               -
               -
               -
               -
           0.60+
               -         A
               -            A
               -
           0.40+
               -
               
               -                                     A
               -
           0.20-                        A
               -                                 A
               -
               -
           0.00+
                 +---------+---------+---------+---------+---------+DAYS
                 0.       30.       60.       90.      120.      150.

MTB > FLOT C7 VS C1
         LEADR,MM
            40.+
               -                                     *
               -                                 *
               -
            30.+                        *
               -
```

FOLDOUT FRAME



MTB > PLOT C7 VS C1



MTB > STOP

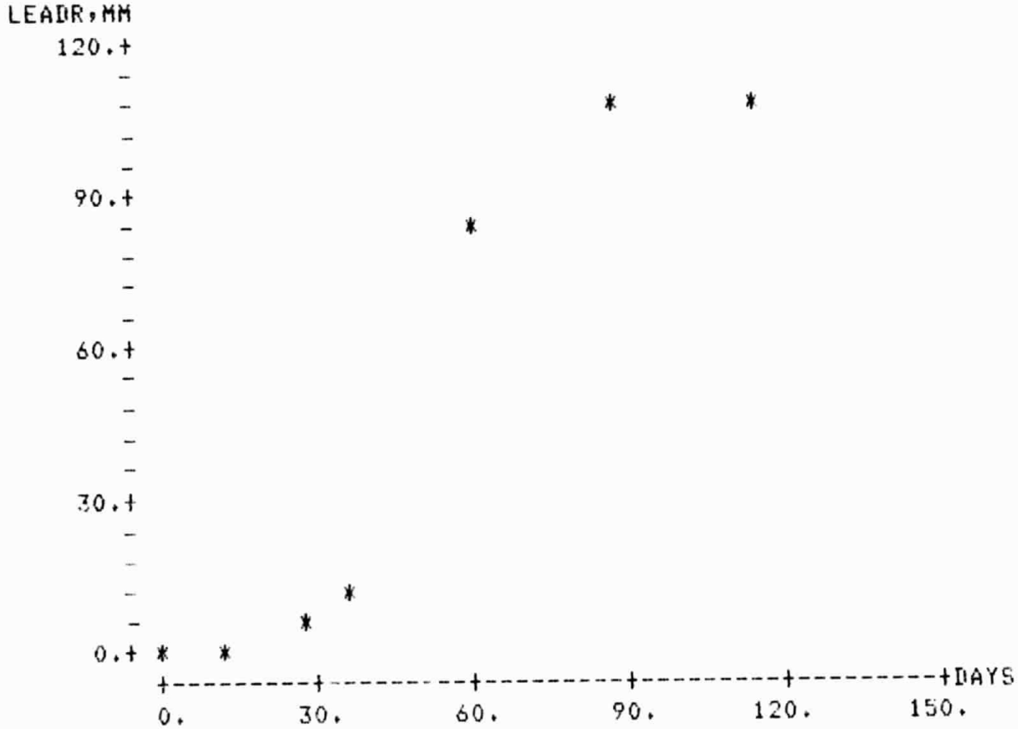
2 FOLDOUT FRAME

Purshea glandulosa

```
MTB > PRINT C1 C3 C4 C6
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1   0.440   0.975      0.00
   2     12   0.300   0.955      1.82
   3     26   0.215   0.943      3.93
   4     37   0.610   0.875     10.03
   5     61   0.240   0.935     86.40
   6     86   0.250   0.940    109.20
   7    115   0.245   0.930    109.20

MTB > MPLOT C3 VS C1 C4 VS C1
           %BROWN
            1.00+
                - B   B    B                   B
                -                    B                  B
                -              B
                -
            0.80+
                -
                -
                -
                -
            0.60+              A
                -
                -
                -
                - A
            0.40+
                -
                -     A
                -
                -                    A         A        A
            0.20+          A
                 +---------+---------+---------+---------+---------+DAYS
                 0.       30.       60.       90.      120.      150.

MTB > PLOT C6 VS C1
         LEADR,MM
            120.+
                -
                -                              *        *
                -
                -
             90.+
                -                    *
                -
                -
                -
             60.+
                -
```

FOLDOUT FRAME

MTB > PLOT C6 VS C1



MTB > STOP

2 FOLDOUT FRAME

Artemesia tridentata, creosote bush site

```
MTB > PRINT C1-C4
 ROW    DAYS  %BROWN   %COVER  LEADR,MM

   1       1    23.0     86.0      8.81
   2      25    25.5     84.5     14.07
   3      59    30.5     73.0     15.05
   4      85    30.5     84.5     15.27
   5     109    32.5     79.5     69.30
   6     136    39.0     76.5     82.00
   7       *       *        *         *
   8       *       *        *         *
   9       *       *        *         *
  10       *       *        *         *

MTB > MPLOT C2 VS C1 C3 VS C1
           %BROWN
             95.+
                -
                -
                - B       B                   B
                -
             80.+                                     B
                -                                              B
                -                   B
                -
                -
             65.+
                -
                -
                -
                -
             50.+
                -
                -
                -
                -                                              A
             35.+
                -                   A         A       A
                -
                -         A
                - A
             20.+
                  +---------+---------+---------+---------+---------+DAYS
                  0.       30.       60.       90.      120.      150.

   8 MISSING OBSERVATIONS

MTB > PLOT C4 VS C1
         LEADR,MM
```

FOLDOUT FRAME

```
     -  A                A
 20.+
     +---------+---------+---------+---------+---------+DAYS
     0.       30.       60.       90.      120.      150.

  8 MISSING OBSERVATIONS

MTB > PLOT C4 VS C1
       LEADR,MM
      100.+
          -
          -
          -
          -
       80.+                                          *
          -
          -
          -
          -                                     *
       60.+
          -
          -
          -
          -
       40.+
          -
          -
          -
          -
       20.+
          -     *           *       *
          -
          - *
          -
        0.+
          +---------+---------+---------+---------+---------+DAYS
          0.       30.       60.       90.      120.      150.

  4 MISSING OBSERVATIONS

MTB > STOP
```

2 FOLDOUT FRAME

Encelia virginensis

```
MTB > PRINT C1-C4
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    99.3    79.5      2.73
   2     25    87.0    83.5     18.00
   3     59    71.5    65.5     31.90
   4     85    66.5    82.0     39.20
   5    109    68.5    81.0     38.50
   6    136    68.0    78.0         *

MTB > MPLOT C2 VS C1 C3 VS C1
          %BROWN
           99.0+ A
               -
               -
               -
               -
           90.0+
               -       B
               -       A
               -
               -                          B
           81.0+                                   B
               - B
               -                                            B
               -
               -
           72.0+                    A
               -
               -                                   A        A
               -                          A
               -                    B
           63.0+
                 +---------+---------+---------+---------+---------+DAYS
                 0.       30.       60.       90.      120.      150.

MTB > PLOT C4 VS C1
        LEADR,MM
            40.+                          *
               -                                   *
               -
               -
               -                    *
            30.+
               -
               -
               -
               -
            20.+
```

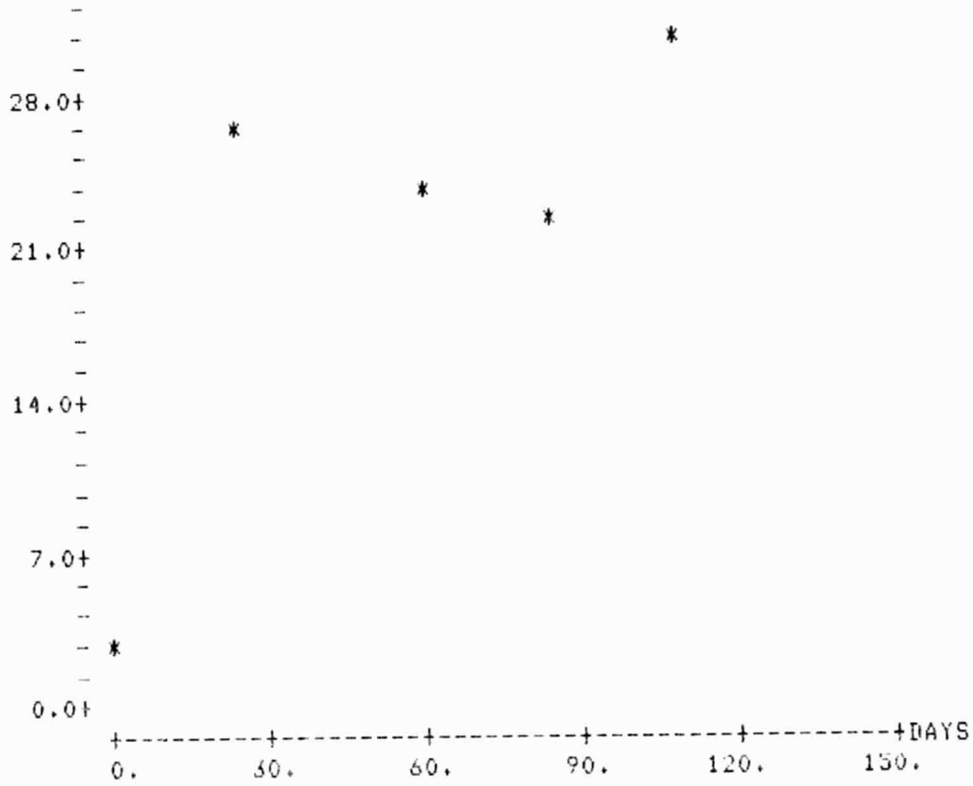
FOLDOUT FRAME

```
                                          A
       -                            B
   63.0+
        +---------+---------+---------+---------+---------+DAYS
        0.       30.       60.       90.      120.      150.

MTB > PLOT C4 VS C1
        LEADR,MM
    40.+                                  *
       -                                          *
       -
       -
       -                            *
    30.+
       -
       -
       -
       -
    20.+
       -         *
       -
       -
       -
    10.+
       -
       -
       -
       - *
     0.+
        +---------+---------+---------+---------+---------+DAYS
        0.       30.       60.       90.      120.      150.

  1 MISSING OBSERVATIONS

MTB > STOP
```

2 FOLDOUT FRAME

```
MTB > PRINT C1-C4 Grayia spinosa
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    76.8    92.5      3.45
   2     25    65.0    94.9     26.30
   3     59    70.0    85.5     24.20
   4     85    75.4    90.0     22.80
   5    109    66.5    92.0     30.30
   6    136    99.0    90.5         *

MTB > MPLOT C2 VS C1 C3 VS C1
   %BROWN
     99.0+                                              A
         -
         -         B
         -
         - B                                   B
     90.0+                             B                B
         -
         -                     B
         -
         -
     81.0+
         -
         - A
         -                             A
         -
     72.0+
         -                     A
         -
         -
         -                                     A
         -         A
     63.0+
           +---------+---------+---------+---------+---------+DAYS
           0.       30.       60.       90.      120.      150.

MTB > PLOT C4 VS C1
 LEADR,MM
     35.0+
         -
         -
         -                                     *
         -
     28.0+
         -         *
         -
         -                     *
         -                             *
     21.0+
         -
         -
```

FOLDOUT FRAME



1 MISSING OPSERVATIONS

MTB > STOPE

FOLDOUT FRAME

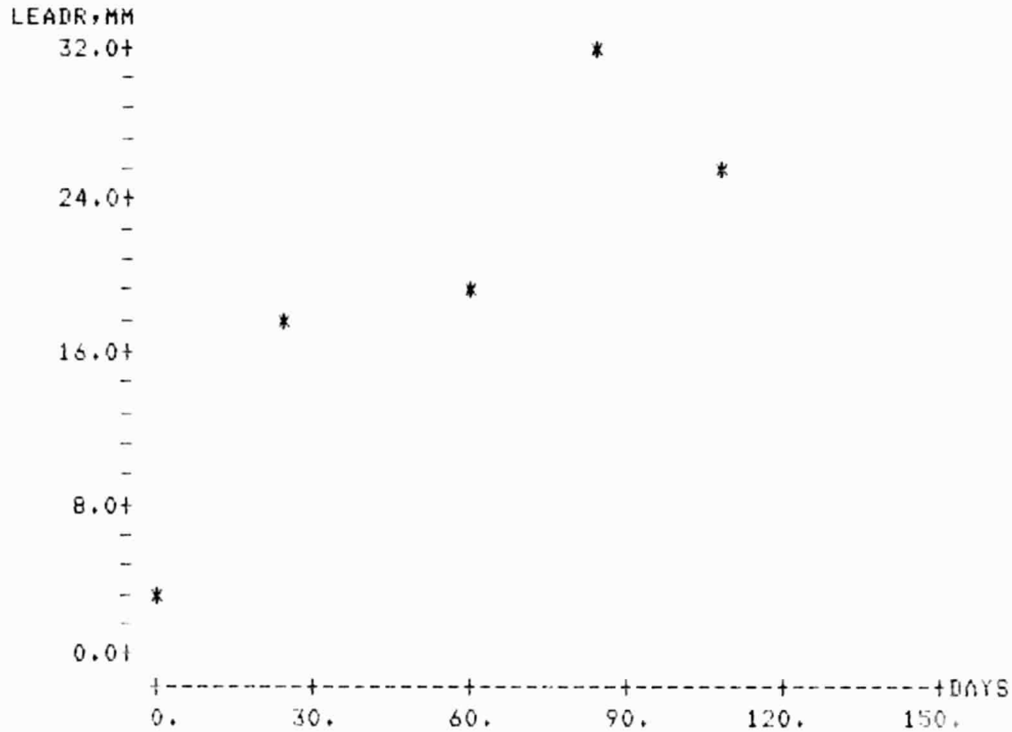
2

Franseria dumosa

```
MTB > PRINT C1-C4
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    75.5    89.0      2.45
   2     25    82.5    94.5     17.20
   3     59    63.5    79.0     19.20
   4     85    57.5    88.5     31.20
   5    109    47.0    84.5     25.40
   6    136    97.0    86.5         *

MTB > MPLOT C2 VS C1 C3 VS C1
      %BROWN
     101.+
         -                                             A
         -         B
         -
         - B                           B
      87.+                                             B
         -                                     B
         -         A
         -                     B
         - A
      73.+
         -
         -
         -                     A
         -
      59.+
         -                             A
         -
         -
         -                                     A
      45.+
           +---------+---------+---------+---------+---------+DAYS
           0.        30.       60.       90.       120.      150.

MTB > PLOT C4 VS C1
    LEADR,MM
     32.0+                             *
         -
         -
         -
         -                                     *
     24.0+
         -
         -
         -                     *
         -         *
     16.0+
         -
```

FOLDOUT FRAME

MTB > PLOT C4 VS C1



1 MISSING OBSERVATIONS

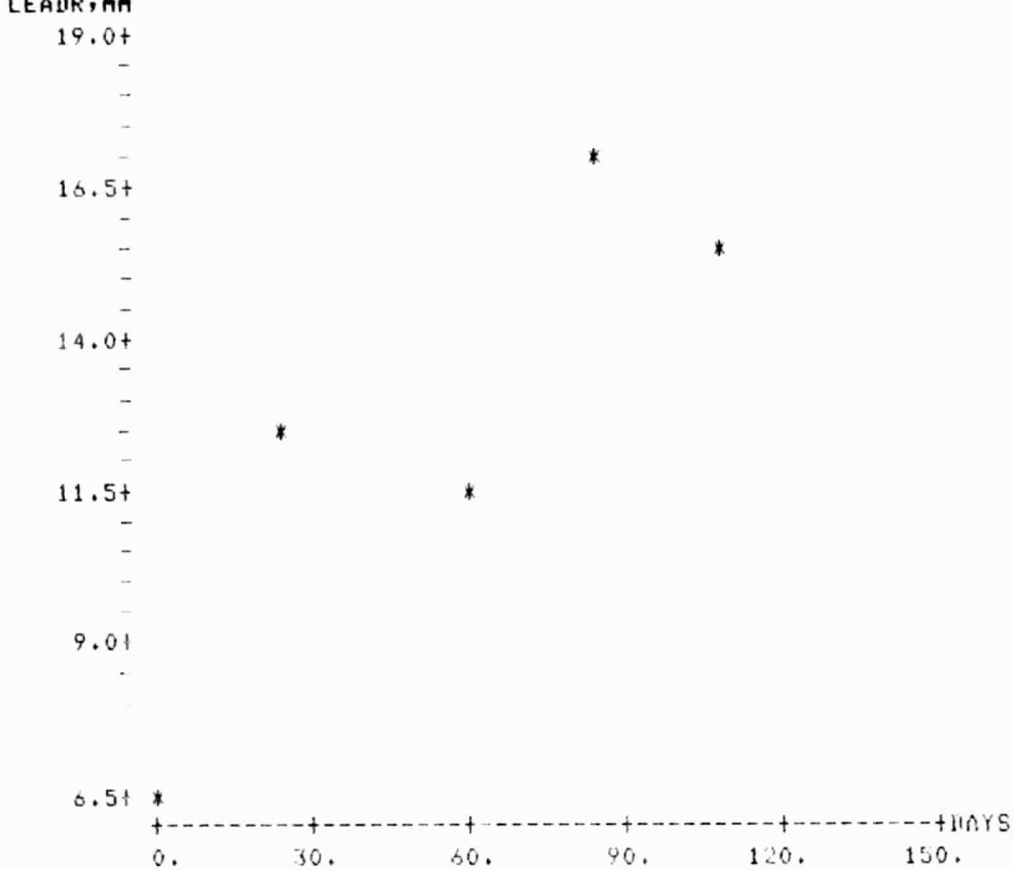
MTB > STOP

2 FOLDOUT FRAME

Larrea tridentata

```
MTB > PRINT C1-C4
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    56.0    50.0      6.71
   2     25    57.0    71.5     12.35
   3     59    67.0    53.5     11.38
   4     85    48.0    65.0     16.97
   5    109    55.6    67.5     15.66
   6    136    48.0    63.0         *

MTB > MPLOT C2 VS C1 C3 VS C1
         %BROWN
          72.0+        B
              -
              -
              -
              -                  A         B
          66.0+
              -                       B
              -
              -                                 B
              -
          60.0+
              -
              -
              - A      A
              -                            A
          54.0+                  B
              -
              -
              - B
              -
          48.0+                       A         A
               +---------+---------+---------+---------+---------+DAYS
               0.       30.       60.       90.      120.      150.

MTB > PLOT C4 VS C1
       LEADR,MM
          19.0+
              -
              -
              -
              -                       *
          16.5+
              -
              -                            *
              -
              -
          14.0+
```

FOLDOUT FRAME



1 MISSING OBSERVATIONS

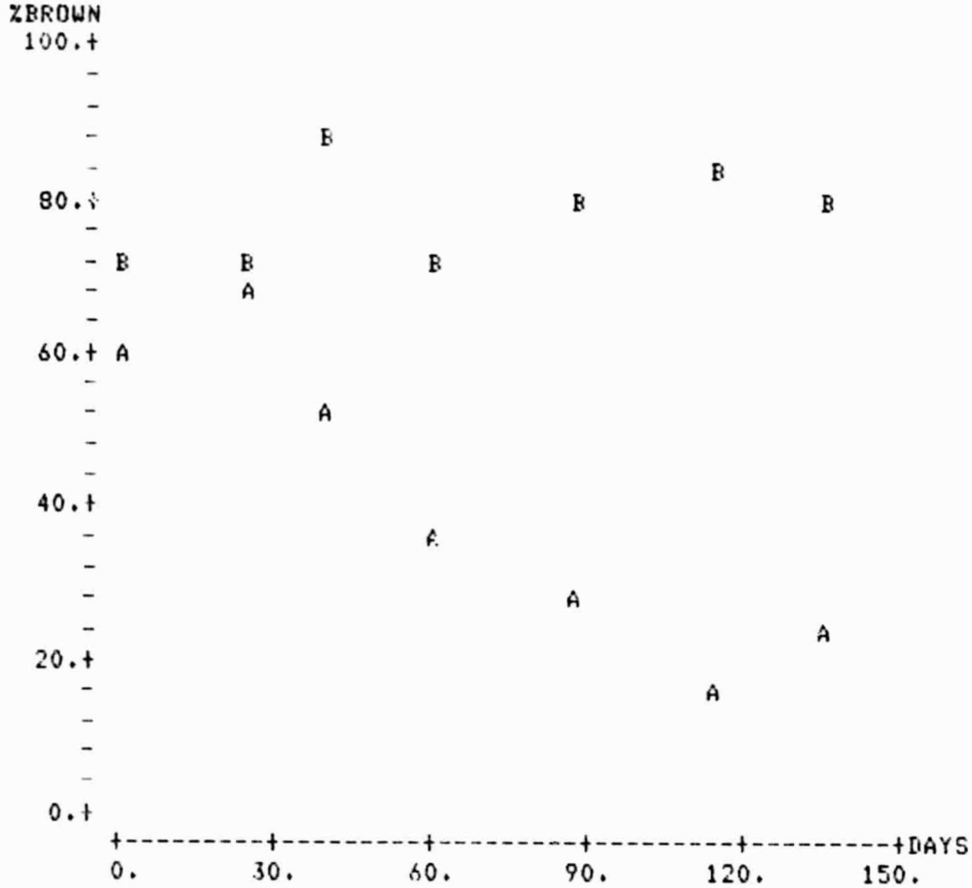
MTB > STOP

2 FOLDOUT FRAME

Atriplex canescens

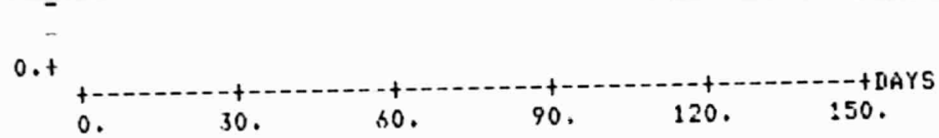
```
MTB > PRINT C1-C4
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    60.5    72.5       0.0
   2     25    66.0    70.0       7.4
   3     38    50.5    88.5      29.1
   4     60    36.0    70.0      51.0
   5     87    27.5    81.4      84.7
   6    114    17.5    84.4     120.5
   7    136    24.7    79.8     132.2
```

MTB > MPLOT C2 VS C1 C3 VS C1

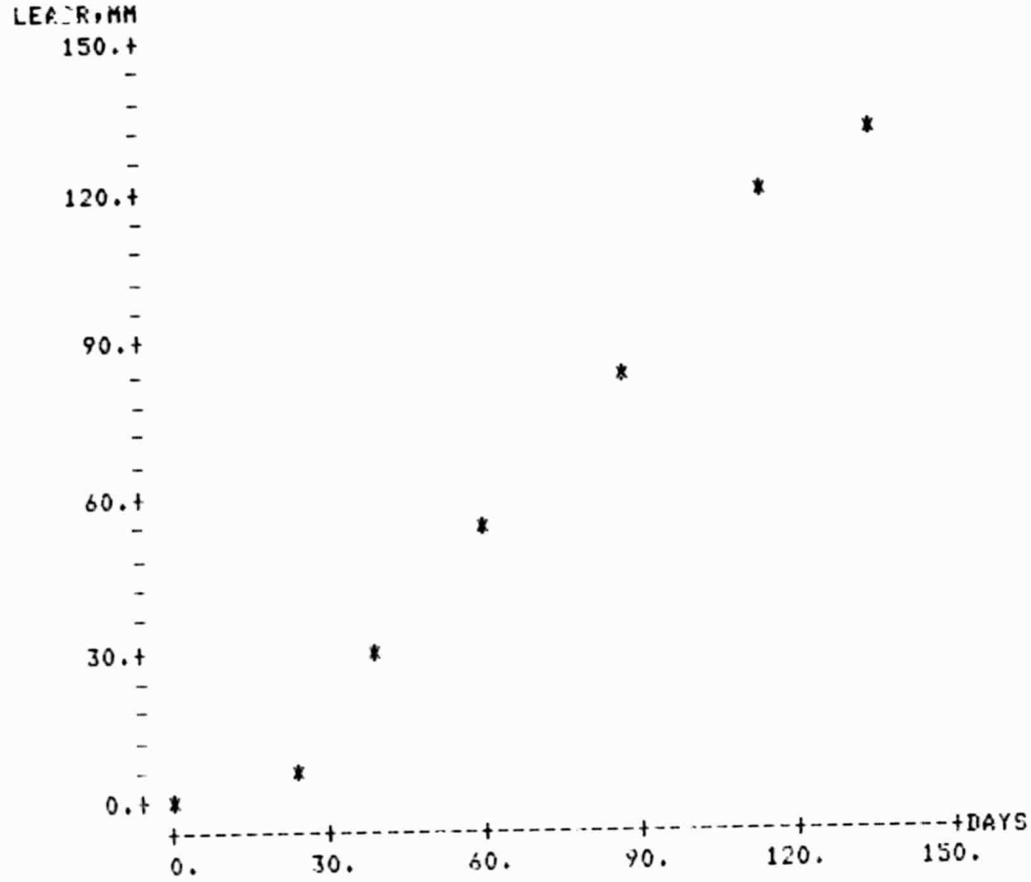


FOLDOUT FRAME

MTB > PLOT C4 VS C1



MTB > PLOT C4 VS C1



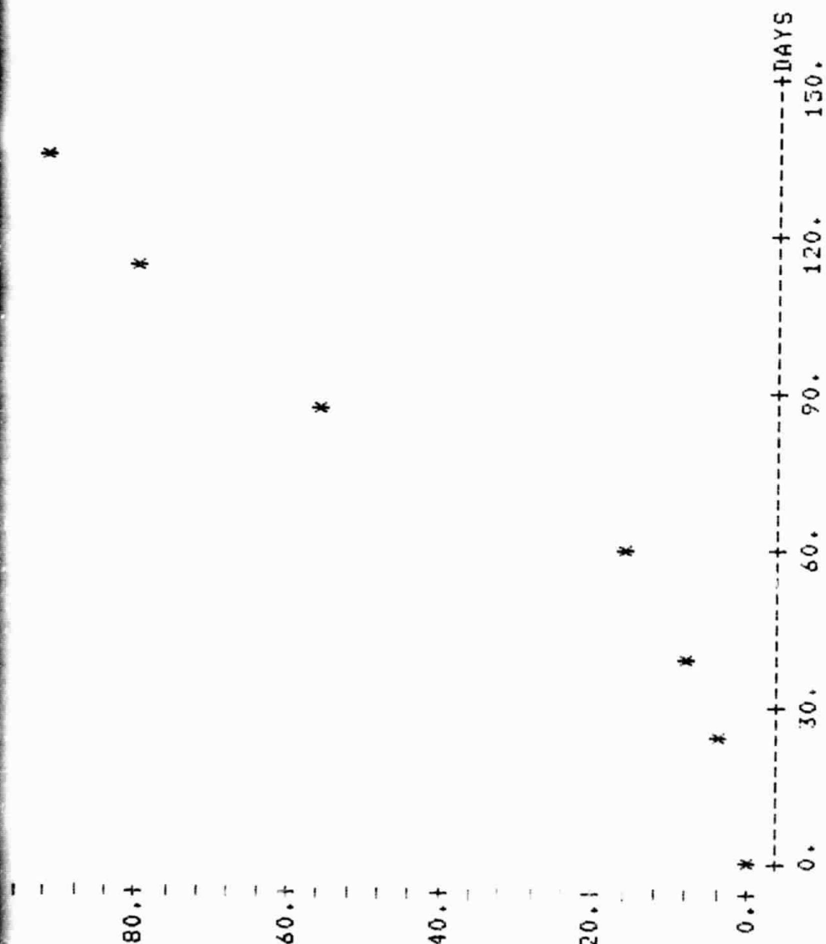
MTB > STOP

2 FOLDOUT FRAME

FOLDOUT FRAME

```
MTB > PRINT C1-C4        Atriplex parryi
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    99.0    80.0     1.432
   2     25    98.7    72.9     2.020
   3     38    98.2    85.9     6.260
   4     60    93.8    64.0    14.770
   5     87    72.0    70.9    55.800
   6    114    52.0    75.0    79.100
   7    136    49.5    85.9    91.200

MTB > MPLOT C2 VS C1 C3 VS C1
   %BROWN
     101.+
         - A       A    A
         -
         -          A
         -
      87.+            B                                B
         -
         - B
         -
         -                                      B
      73.+       B                    A
         -                            B
         -
         -          B
         -
      59.+
         -
         -                                      A
         -                                             A
         -
      45.+
           +---------+---------+---------+---------+---------+DAYS
           0.       30.       60.       90.      120.      150.

MTB > PLOT C4 VS C1
 LEADR,MM
     100.+
         -
         -                                             *
         -
         -
      80.+                                      *
         -
         -
         -
         -
      60.+
```

2 FOLDOUT FRAME



MTB > STOP

Distichlis spicata

MTB > PRINT C1 C5 C6

ROW	DAYS	MEANHT	MEANCOV
1	1	0.0	24.300
2	25	0.0	25.000
3	38	31.3	0.306
4	60	50.9	0.109
5	87	68.5	0.873
6	114	100.3	3.800
7	136	112.4	10.500

```
MTB > PLOT C5 VS C1
         MEANHT
          120.+
              -                                            *
              -                                      *
              -
              -
           90.+
              -
              -
              -
              -                               *
           60.+
              -
              -                        *
              -
              -
           30.+               *
              -
              -
              -
              -
            0.+ *       *
                +---------+---------+---------+---------+---------+DAYS
                0.       30.       60.       90.      120.      150.
```

FOLDOUT FRAME

```
MTB > PLOT C6 VS C1
        MEANCOV
          28.0+
              -
              -         *
              - *
              -
          21.0+
              -
              -
```

```
         0.       30.       60.       90.      120.      150.

MTB > PLOT C6 VS C1
      MEANCOV
     28.0+
        -
        -        *
        - *
        -
     21.0+
        -
        -
        -
        -
     14.0+
        -
        -
        -
        -                                             *
      7.0+
        -
        -
        -                                      *
        -                             *
     0.0+             *      *
         +---------+---------+---------+---------+---------+DAYS
         0.       30.       60.       90.      120.      150.

MTB > STOP
```

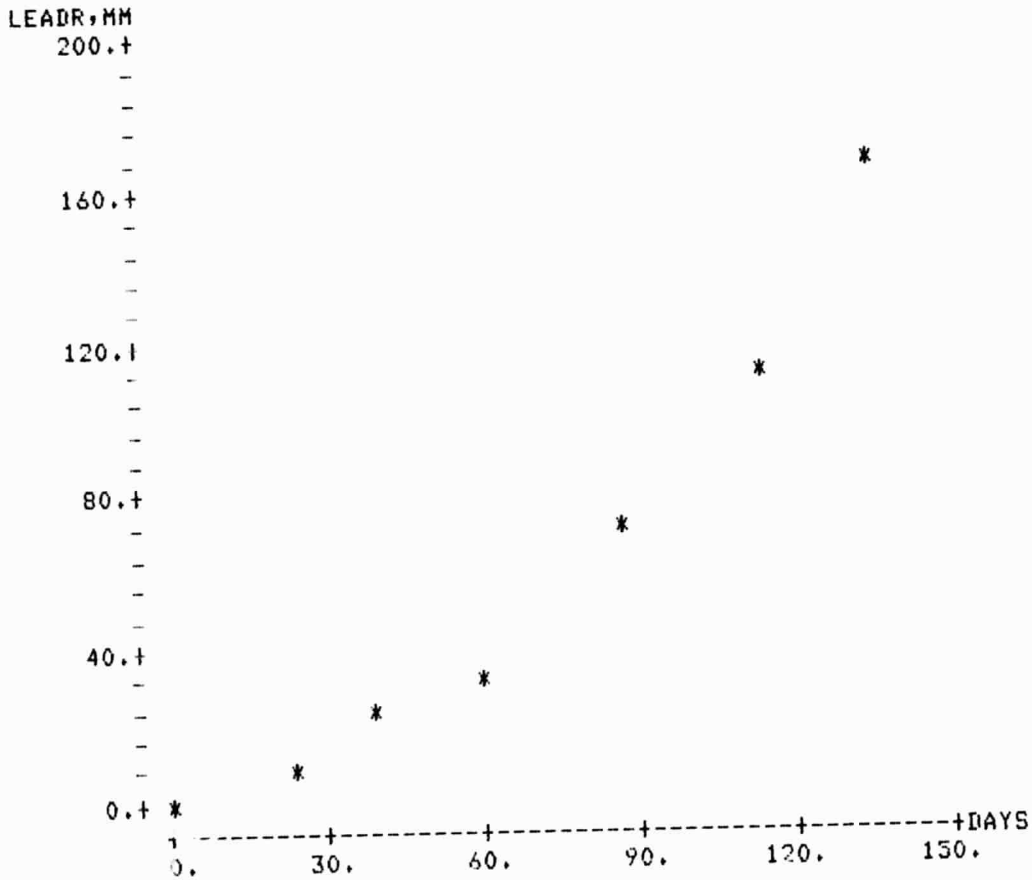
2 FOLDOUT FRAME

Sarcobatus

```
MTB > PRINT C1-C4
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    95.4    66.0      3.43
   2     25    85.4    67.5      5.77
   3     38    59.5    74.0     21.43
   4     60    54.0    56.5     32.40
   5     87    21.5    76.0     72.70
   6    114    40.0    74.4    109.10
   7    136    82.5    82.2    164.40

MTB > MPLOT C2 VS C1 C3 VS C1
           %BROWN
            100.+
               - A
               -
               -
               -       A                            2
             80.+
               -            B               B        B
               -
               - B     B
               -
             60.+           A
               -                   2
               -
               -
               -
             40.+                                    A
               -
               -
               -
               -
             20.+                           A
                 +---------+---------+---------+---------+---------+DAYS
                 0.       30.       60.       90.      120.      150.

MTB > PLOT C4 VS C1
         LEADR,MM
            200.+
               -
               -
               -
               -                                           *
            160.+
               -
               -
               -
               -
```

FOLDOUT FRAME

MTB > PLOT C4 VS C1



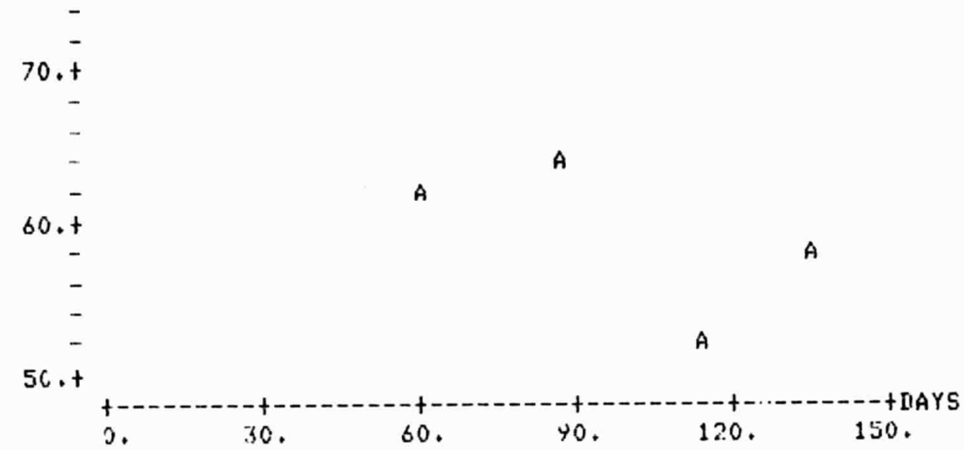
MTB > STOP

2 FOLDOUT FRAME

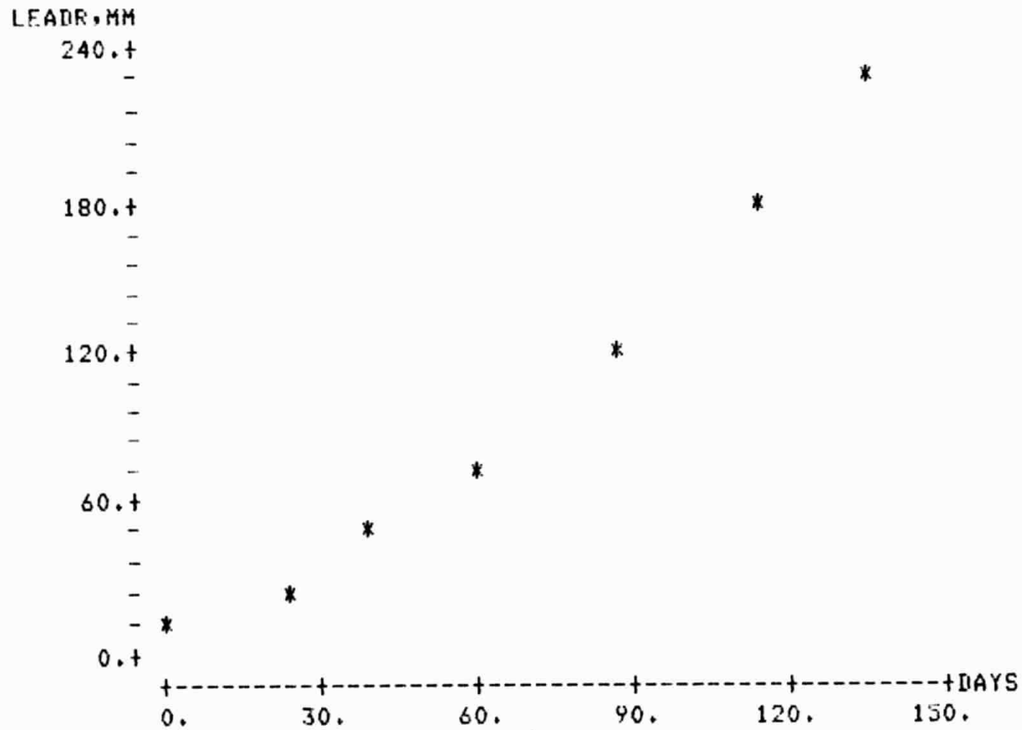
Suaeda

```
MTB > PRINT C1 C3 C5 C6
 ROW   DAYS  LEADR,MM  %BROWN  %COVER

   1      1      9.10   0.840   0.865
   2     25     18.77   0.859   0.845
   3     38     48.00   0.810   0.935
   4     60     66.50   0.625   0.795
   5     87    120.20   0.640   0.860
   6    114    180.90   0.510   0.855
   7    136    230.90   0.588   0.872
   8                *       *       *
   9                *       *       *
  10                *       *       *

MTB > MPLOT C5 VS C1 C6 VS C1
* ERROR * COLUMN LENGTHS NOT EQUAL

MTB > STOP
MTB > PRINT C1-C4
 ROW   DAYS  %BROWN  %COVER  LEADR,MM

   1      1    84.0    86.5      9.10
   2     25    85.9    84.5     18.77
   3     38    81.0    93.5     48.00
   4     60    62.5    79.5     66.50
   5     87    64.0    86.0    120.20
   6    114    51.0    85.5    180.90
   7    136    58.8    87.5    230.90

MTB > MPLOT C2 VS C1 C3 VS C1
           %BROWN
            100.+
                -
                -
                -              B
                -
             90.+
                -                                               B
                - B       A                     B        B
                - A       B
                -              A
             80.+                     B
                -
                -
                -
                -
             70.+
                -
                -
                -                               A
                -                     A
```

FOLDOUT FRAME



MTB > PLOT C4 VS C1



MTB > STOP

2 FOLDOUT FRAME

B. % vegetation cover at selected sagebrush sites

```
MTB > PRINT C1-C7
 ROW  SYMBURN  SYMOFFB  SAGOFFB  SAGEBURN  DIVCROFB  CREOSOFB  SALTBUSH

   1     12.2     30.8     29.1      16.4      26.6      24.9       6.4
   2     14.2     29.6     35.6      16.8      41.8         *      14.0
   3     21.8     36.0     37.6      16.6      35.8         *         *
   4     24.8     34.0     29.8      29.4      31.2         *         *
   5     15.0     33.2     36.4      21.4      28.2         *         *
   6     12.6        *        *      22.8      30.0         *         *
   7      7.0        *        *      33.4      12.0         *         *
   8     14.6        *        *      29.2      30.6         *         *
   9     16.9        *        *      24.4      25.8         *         *
  10     22.6        *        *      21.6      33.4         *         *

MTB > AOVO C2 C1

ANALYSIS OF VARIANCE
SOURCE     DF        SS       MS        F
FACTOR      1     913.0    913.0    40.32
ERROR      13     294.4     22.6
TOTAL      14    1207.4
                                  INDIVIDUAL 95 PCT CI'S FOR MEAN
                                  BASED ON POOLED STDEV
LEVEL       N      MEAN    STDEV  ---+---------+---------+---------+---
SYMOFFB     5     32.72     2.55                     (------*-----)
SYMBURN    10     16.17     5.46  (----*---)
                                  ---+---------+---------+---------+---
POOLED STDEV =   4.76             15.0      22.5      30.0      37.5
MTB > AOVO C2 C3

ANALYSIS OF VARIANCE
SOURCE     DF        SS       MS        F
FACTOR      1       2.4      2.4     0.22
ERROR       8      88.5     11.1
TOTAL       9      90.9
                                  INDIVIDUAL 95 PCT CI'S FOR MEAN
                                  BASED ON POOLED STDEV
LEVEL       N      MEAN    STDEV  --------+---------+---------+--------
SYMOFFB     5     32.72     2.55  (-------------*-------------)
SAGOFFB     5     33.70     3.95     (-------------*-------------)
                                  --------+---------+---------+--------
POOLED STDEV =   3.33                    31.2      33.6      36.0
MTB > AOVO C3 C4

ANALYSIS OF VARIANCE
SOURCE     DF        SS       MS        F
FACTOR      1     367.5    367.5    12.60
ERROR      13     379.1     29.2
TOTAL      14     746.6
                                  INDIVIDUAL 95 PCT CI'S FOR MEAN
                                  BASED ON POOLED STDEV
```

FOLDOUT FRAME

```
ANALYSIS OF VARIANCE
SOURCE      DF        SS        MS        F
FACTOR       1     367.5     367.5    12.60
ERROR       13     379.1      29.2
TOTAL       14     746.6
                                    INDIVIDUAL 95 PCT CI'S FOR MEAN
                                    BASED ON POOLED STDEV
LEVEL        N      MEAN     STDEV  --------+---------+---------+--------
SAGOFFB      5     33.70      3.95                 (--------*--------)
SAGEBURN    10     23.20      5.93   (-----*-----)
                                    --------+---------+---------+--------
POOLED STDEV =   5.40                    24.0      30.0      36.0
MTB >
MTB >
MTB >
MTB >
MTB > AOVO C3 C5

ANALYSIS OF VARIANCE
SOURCE      DF        SS        MS        F
FACTOR       1      57.7      57.7     1.24
ERROR       13     603.0      46.4
TOTAL       14     660.7
                                    INDIVIDUAL 95 PCT CI'S FOR MEAN
                                    BASED ON POOLED STDEV
LEVEL        N      MEAN     STDEV  -+---------+---------+---------+-----
SAGOFFB      5     33.70      3.95      (------------*------------)
DIVCROFB    10     29.54      7.75   (--------*--------)
                                    -+---------+---------+---------+-----
POOLED STDEV =   6.81              25.0      30.0      35.0      40.0
MTB > AOVO C1 C4

ANALYSIS OF VARIANCE
SOURCE      DF        SS        MS        F
FACTOR       1     247.1     247.1     7.60
ERROR       18     585.0      32.5
TOTAL       19     832.1
                                    INDIVIDUAL 95 PCT CI'S FOR MEAN
                                    BASED ON POOLED STDEV
LEVEL        N      MEAN     STDEV  ----------+---------+---------+------
SYMBURN     10     16.17      5.46   (--------*---------)
SAGEBURN    10     23.20      5.73                  (--------*--------)
                                    ----------+---------+---------+------
POOLED STDEV =   5.70                    16.0      20.0      24.0
MTB > STOP
```

2 FOLDOUT FRAME