# VIEWIT: computation of seen areas, slope, and aspect for land-use planning

Michael R. Travis Gary H. Elsner
Wayne D. Iverson Christine G. Johnson

PACIFIC SOUTHWEST
Forest and Range
Experiment Station

FOREST SERVICE
U.S DEPARTMENT OF AGRICULTURE
P.O BOX 245, BERKELEY, CALIFORNIA 94701

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This user's guide provides instructions for using VIEWIT–a computerized technique for delineating the terrain visible from a single point or from multiple observer points, and for doing slope and aspect analyses. Results are in tabular or in overlay map form. VIEWIT can do individual view-area, slope, or aspect analyses or combined analyses, and can produce elevation profile charts between any two points in a study area. The guide explains how to prepare data, select available options, and interpret results. VIEWIT is designed to operate on a Univac 1108 computer with Exec-8 operating system. The VIEWIT system is accessible via remote terminals to the USDA Fort Collins Computer Center. For those not having access to this computer facility, the programs are available on request to: Director, Pacific Southwest Forest and Range Experiment Station, P. O. Box 245, Berkeley, California 94701, Attention, Computer Services Librarian. The programs will be copied on a magnetic tape to be supplied by the requestor.

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## The Authors

**MICHAEL R. TRAVIS** is a senior programmer in the School of Forestry and Conservation, University of California, Berkeley, on assignment to this Pacific Southwest Forest and Range Experiment Station. He was educated at the University of California (A.B. degree in physics, 1963 and J.D. degree, 1968). **GARY H. ELSNER** is in charge of the Station's forest recreation research unit, at Berkeley. He received degrees in agricultural economics at the University of Arkansas (B.S., 1962) and the University of California (M.S., 1964, and Ph.D., 1966). **CHRISTINE G. JOHNSON,** formerly a landscape architect in the Forest Service's California Region, in San Francisco, is now with the Federal Highway Administration, in Boston, Mass. She holds a B.S. degree in landscape architecture (1968) from the University of Massachusetts. **WAYNE D. IVERSON** is regional landscape architect, Forest Service California Region, San Francisco. He earned a B.S. degree (1955) and an M.S. degree (1956) in landscape architecture at the University of Wisconsin.

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# FOREWORD

VIEWIT is a computerized technique for delineating the terrain visible from a single point or from multiple observer points. The results are produced in either tabular or in overlay map form. VIEWIT can also be used to prepare terrain slope and aspect analyses. In addition, the system may be used to do combined analyses of seen area with aspect relative to the observer points and weighted by the distance to seen areas from observer points. The system will also produce elevation profile charts between any two points in the study area. Besides these basic capabilities, VIEWIT has many options for seen-area analyses and for aspect analyses. The system has been developed over an eight-year period and the original "seen-area" program was published in 1968.[1]

The system has been used to help manage and plan lands which are visually important. Examples of applications include timber harvesting, mining, scenic tramway routes, bridge proposals, transportation system alternatives, ski runs, roads, recreation developments, and fuelbreaks. Additionally, VIEWIT is being used to determine visual impact, and terrain slope and aspect information for land-use planning.

VIEWIT provides capabilities for several kinds of analyses of digital terrain data. The basic input to the program is a grid of elevation points representing the area of interest. A second program input is a series of user requests that define the form of the elevation data and cause various operations to be performed. The system then produces tables and maps showing the results of these requests.

VIEWIT is designed to operate on the Univac 1108 computers with Exec-8 operating systems.

### What Can VIEWIT Do?

VIEWIT can do these jobs:

1. Verify the consistency of digitized topographic data through the Data Check option and print maps in numeric or gray scales as well as tables showing those cells or cell clusters which do not meet specified tolerances of elevation with their eight neighboring cells.

2. Express in tables showing square miles, acres, and hectares the area within the study unit that can be seen from any single point on the ground or at any point above the ground level, map the location of these seen areas.

3. Express the above information in composite form from many viewing points within the study area (viewing points may represent alternative roads, trails, or other development systems); map these seen areas on a numerical printout which indicates the number of times each cell is visible from the viewing points; map these seen areas on a gray scale printout which shows all cells visible from 0 to 9 and more than nine times seen in shades of gray, map these seen areas as a percentage of times each cell is seen from the total number of observer positions, and print out in numerical or gray scale maps or both, thereby providing further mapping refinement to cells seen more than 10 times.

4. Evaluate only a portion of a study area (subrectangle) to save time and funds.

5. Evaluate only specified sectors of view such as 0° to 90°, 180° to 220°, or combinations of sectors.

6. Evaluate only specified vertical angles of view.

7. Evaluate only user-specified classes for slope, aspect and elevation analyses.

8. Develop profile printouts in line with (X,Y) coordinates or diagonal to these coordinates in any length specified.

9. Develop tables, numeric maps, and gray shade maps of elevation values.

10. Develop tables, numeric maps, and gray shade maps of slope classes as specified. Slope may be computed by fitting a plane to the eight neighboring cells or by finding the maximum slope to these cells.

11. Develop tables, numeric maps, and gray shade maps of aspects by 36 10-degree classes.

12. Develop tables, numeric maps, and gray shade maps of aspect by eight sectors of 45°, each centered on the principal compass points.

13. Develop tables, numeric maps, and gray shade maps of aspect by eight sectors of 45°, each with weighting from most desirable to least desirable from any direction which is specified to be most desirable.

14. Develop "aspect relative to the observer" (vertical tilting and horizontal rotation of the plane of the grid cell) weighting tables, numeric maps, and gray shade maps. This weighting is one of the functions of "visual magnitude" weighting. It can be done for one viewing point or for many.

15. Develop distance-weighting tables, numeric maps, and gray shade maps. This weighting can be

[1] Amidon, Elliot L., and Gary H. Elsner. 1968. *Delineating landscape view areas . . . a computer approach.* USDA Forest Serv. Res. Note PSW-180, 5 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

adjusted to allow for up to 20 changes in the distance weights. Weights may relate to foreground, middleground, and background distances or (e.g.) weights may be specified to give greater weights to middleground or the middle areas. It can be done for one viewing point or for many.

16. Develop combined distance, "aspect relative to the observer" and times seen tables, numeric maps, and gray shade maps. These three functions combined measure the relative visual magnitude of each grid cell or the "visual perception sensitivity" of each cell.

### Examples of Applications

What are some specific situations and examples in which VIEWIT has been applied? And what parts or options of the program would be useful if you were developing a land-use plan for a visually sensitive unit?

First, after data collection and preparation you would perform a Data Check to verify accuracy. Next, select the key viewing points in the unit and test a combination of distance weighting, "aspect relative to observer weighting," and times seen table which would list the total acreages of each of 10 combined weighting categories and then produce a gray shade map of these combined weightings. This provides a map of the "visual perception sensitivity" of the unit in fine detail. (It would possibly take months to do this work by manual methods–especially to combine the weightings of numerous viewing points.)

In almost every land-use planning situation you would want to develop a slope class map or perhaps several types of slope class maps. For areas that could be logged by tractors the slope class map and the tables could be examined to determine area slopes less than 35 percent. For potential ski areas, slopes between 10 percent and 80 percent could be determined by VIEWIT.

For other uses the aspect options may be valuable. The 45° aspect map with eight weighted sectors might be given highest weighting for northeast exposure to map out best ski area or vegetative regeneration potential or selected microclimatic conditions. Overlay the slope and aspect maps for ski area potential, and potential areas would be immediately apparent. If maximum exposure to sunlight were a criterion, the southwest exposure map printout in gray shades would be most useful. These are just a few of the options that may be helpful.

For an example of project application, consider a power transmission line proposal across a section of land which you manage. If the proposal is of a general nature in location, you may wish to check its potential visual impact against the "visual perception sensitivity" map prepared in land-use planning (or if this was not done you may want to select key viewing points and produce a printout map). If the proposal is a specific one with tower locations designed, you can set the viewing point at the top of each tower and develop tables and maps which show the acreage on which each tower would visually have impact, or the combined visual impact of all the towers. If the digitized topographic data is already available and you have a computer specialist and a high-speed terminal, this table output and mapping could take just a matter of minutes to prepare in response to the special-use proposal. The same visual impact analysis could quickly be made of a highway proposal, a proposed building, electronic relay, a clearcut block, or a scenic tramway.[2]

For fire detection planning, the system can be used to map the seen area of existing fixed fire detection stations and to prepare composite seen area maps with additional or reduced numbers of stations. These analyses are then helpful in evaluating the location and height of new stations in specifying a system of stations.

### Should You Use VIEWIT?

Before investing time and funds in using VIEWIT, the potential user should answer these questions:

1. Are visual resources of great importance in the proposed project or land-use planning activity? Will they have major effects on decisions?

2. Can the visual analysis be handled through other means with less investment?

3. Does the user have access to a high-speed printer terminal? If not, can the user work with turnaround times involved in mailing of input and output data from other offices; or can work be handled by short details of individuals to such offices?

4. Is the format of output data compatible with other data output? If not, can it be converted to compatible data by manual graphics (outlining areas or coloring in areas of similar output characteristics).

5. If the value of visual analyses is marginal, will the optional outputs, such as slope and aspect maps and tables, offset the marginal values in favor of using VIEWIT?

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[2] Elsner, Gary H. 1971. *Computing visible areas from proposed recreation developments . . . a case study.* USDA Forest Serv. Res. Note PSW-246, 10 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

6. Is there high potential for future use of the input data after its initial usage? For instance, would there be possibilities of power transmission, road, timber sale, electronic relay site, etc., proposals within this land unit? If so, visual impacts could be determined within minutes or hours of the proposal at negligible costs.

7. Are there possibilities that several slope and aspect classifications will be needed for planning and design consideration? This program is flexible in producing several kinds of slope and aspect classifications initially or at later dates with no change in stored data.

8. Will computer-generated output data be accepted by management and the public as valued information for decisionmaking? Will quantitative estimates of visual impacts of alternative land uses be useful in developing land-use or project plans?

This guide provides detailed instructions on how to use the VIEWIT system. Appendix I lists a sample deck of punched cards in the form in which they would be submitted to the computer, and illustrates the computer printout. Appendix II illustrates the use of a preprocessor program with data in a form that cannot be read directly by VIEWIT.

The VIEWIT system is accessible via remote terminals to the USDA Fort Collins Computer Center. For those not having access to this computer facility, the programs are available on request to: Director, Pacific Southwest Forest and Range Experiment Station, P. O. Box 245, Berkeley, California 94701, Attention, Computer Services Librarian. The programs will be copied on a magnetic tape to be supplied by the requestor.

## 1. IDENTIFYING BOUNDARIES AND CELL SIZE

The first step in using VIEWIT is to decide on the area boundaries. The area boundary may be determined by the boundary of the unit plan and its visual influence area. For instance, a unit plan or project boundary may be limited to primarily the National Forest land on the face of a mountain, but activities on that unit could visually impact a community in the valley below. Therefore, the VIEWIT boundary should extend beyond the planning unit boundary so that the system can accommodate viewing points and allow for any screening terrain that limits the visibility of the project area or land unit.

The second step is to mark the boundary on a USGS map (same scale as later used in data collection such as 1 inch = 1 mile, 1 inch = 2 miles).

### 1.1 Subdivide into Grid Cells

Subdivide the rectangle enclosing the area of interest into cells. Each cell is a minimum element for analysis. The cells may be rectangular rather than square. Smaller cells allow a more accurate analysis of seen areas, slope and aspect, but require more data collection effort and more computer costs for analysis.

### 1.2 Decide on Cell Size and Shape

Decide on the cell size needed for the planning effort. If the computer output map is to be used as an overlay the topographic map at later stages and a high-speed line printer is the output method, the cells should be rectangular to conform to the 1/5 inch x 1/6 inch character type of a printer now.

For example:

| | Cell Size = |
|---|---|
| 1 inch = 1 mile | 21.33 acres @ 1/5 inch x 1/6 inch |
| 2 inches = 1 mile | 5.4 acres @ 1/5 inch x 1/6 inch |
| 1:24,000 (7½-min. quad.) | 3.1 acres @ 1/5 inch x 1/6 inch |
| 1:62,500 (15-min. quad.) | 20.6 acres @ 1/5 inch x 1/6 inch |

To decide on map scale to cell size, consider (a) the amount of detail required for the study; (b) the variation or complexity of terrain; (c) time and dollars available; and (d) whether the data will be used again for more detailed studies with VIEWIT.

The map scale chosen for the VIEWIT analyses should be compatible with that used for other planning variables. It may also be important to choose a cell size and scale which is the same as adjacent planning units.

Not enough experience has been gained as yet to pin down firmly the costs of digitized terrain data, but we have found that the work may be done on a contract basis for approximately 1½ to 2 cents per cell through the use of automatic digitizing equipment. The cost may go as high as 4 cents per cell. Manual digitization (in-service by experienced personnel) has been done at costs of up to 8 cents per cell. This cost data should change rapidly once more experience is gained both with in-service automated digitizing and contracted digitizing of topographic data.

## 2. PREPARING TERRAIN DATA IN COMPUTER-READABLE FORM

Once the elevation grid location and size have been chosen, the elevations must be put in machine-readable form. This form will usually be punched cards but could be magnetic tape if storage space is a consideration. Frequently, the elevation data will be permanently stored in card form in the office with a tape of this information being used at the computer facility.

No one specific format is required for the elevation data. The user should choose a format that is compact, convenient, and has the required amount of precision. For example, it may be helpful to omit the last (units) digit of elevations to save space on the data medium and to record only the minimum necessary row and column information on each data card.

Many alternative procedures are available for obtaining computer readable digital topographic data (DTD). Topographic maps should be obtained to the same scale for the entire study area. The USGS 7½-minute maps are often the most accurate available. Obtaining these topographic maps is an important first step for any procedure. Some of the basic digitization procedures are:

1. Overlaying a topographic map on a <u>light table</u> with a data grid and coding elevation values directly into each cell.

2. Using automatic <u>digitizer</u> equipment to record contours and their elevation values in line form and utilizing additional software to convert and interpolate to a uniform grid.

3. Obtaining the digital terrain data on magnetic tapes from the U. S. Defense Mapping Agency and using additional software to assist in data verification and interpretation for the study area.

4. Use of outside consultant contract for preparation of digitized topographic data tapes either by manual or automatic digitizing equipment.

### 2.1 Hand Code Elevation Data

This method involves using a light table and topographic map to obtain computer-readable terrain data. This procedure may be preferable if the study area is small, and individuals with coding expertise are available.

1. Prepare a gridded map overlay (select a rectangular grid, with a ratio of: 1/5 by 1/6 inch if output is by high-speed line printer).

2. Place $7\frac{1}{2}$-minute or 15-minute map on light table and overlay with data grid (tape both to table).

3. Code two-digit (hundreds of feet) elevation values in each cell.

4. Have data sheets cardpunched and verified (OCR forms are a possible option).

5. Use simple computer programs to read, fill the data matrix, and to print an overlay data map to assist in checking of the data for accuracy.

2.2 Digitize Elevation Data

Use digitizers to record contours and elevation values. This procedure is faster and more complex than the procedure just described. It is more appropriate if a large area is to be modeled. It involves handling the information on computer-readable tapes, and thus the operator should have experience in writing programs for reading and writing large data storage tapes. The following basic steps are involved in using this procedure.

1. Digitize contours

2. Check readability of contour tapes

3. Prepare uniform grid data from contour tapes: (a) check a sample of points by overlaying coded elevation map on original topo map; (b) select cell size carefully in order to produce one-to-one overlay maps (1/5 by 1/6 inch if output is by high-speed line printer).

4. If necessary digitize more contours and add to data base

5. Complete data matrix by interpolation

6. Check accuracy of data matrix

7. Correct data matrix if necessary

2.3 Obtain Digital Terrain Tapes

Digital terrain tapes are available for the continental United States and parts of Alaska. The information has been digitized from 1/250,000-scale USGS topographic maps and interpolated to produce a data print for about every 208.33 feet on the ground. The magnetic tape used is $\frac{1}{2}$-inch IBM compatible, recorded in odd parity, binary at 556 bpi using an inter-record gap of 0.75 inch. Two 2,400 feet reels of tape contain the DTD for one 1/250,000-scale topographic map sheet. Tapes are provided to users for them to copy and return originals to the U. S. Defense Mapping Agency. The DMA data are accurate within about ± 400 feet horizontally and ± 100 feet vertically. Map indexes of available DTD tapes are available from the National Cartographic Information Center, U.S. Geological Survey, 507 National Center, Reston, Virginia 22092. Obtaining the tapes from the Center may take several weeks or a few months. The VIEWIT system provides automatic user-oriented access to these tapes.

2.4 Explore Contract Digitizing

Using consultant computer firms for digitizing topographic data has the possibility of being more economical than the other two methods. The larger the area, the more likely that this method will be the best alternative. The following steps are recommended:

1. Develop specifications or modify existing specifications for topographic digitization.

2. Develop a coordinate system grid on the topographic map to be supplied to the contractor.

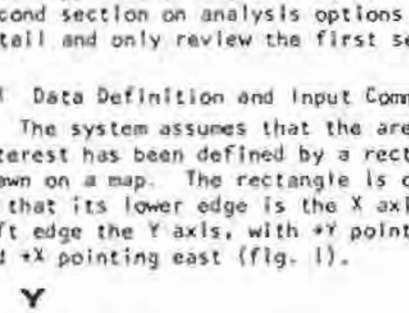
3. Prepare and execute contract action.

3. IMPLEMENTING VIEWIT

The first following section on data definition and input is intended for the members of the analysis team with programming knowledge and responsibilities. Those users not involved directly with the computer application may wish to refer to the second section on analysis options in more detail and only review the first section.

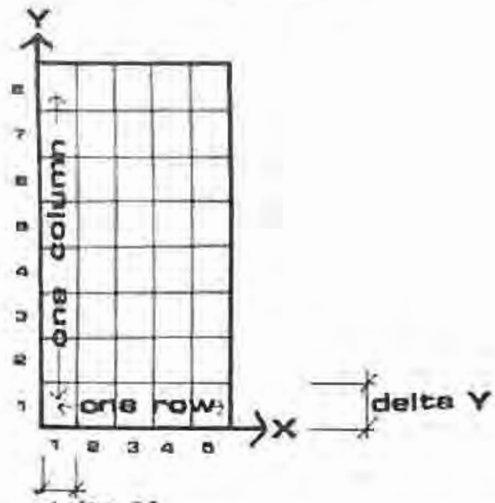
3.1 Data Definition and Input Commands

The system assumes that the area of interest has been defined by a rectangle drawn on a map. The rectangle is oriented so that its lower edge is the X axis, its left edge the Y axis, with +Y pointing north and +X pointing east (fig. 1).




(If the +Y axis of the data grid is not aligned with north, the program can be told to compensate for this, see the ROTATE option in the following table of commands and following discussion.)

This rectangle is divided into cells of a convenient size, and each cell has been assigned an elevation by one of the methods discussed in Section 2. The lower leftmost cell is cell (1,1). The number of cells across the rectangle is the number of columns, NCOLS, and the number of cells from bottom to top is the number of rows, NROWS. Each cell is DELTAX inches wide (on the map) and DELTAY inches high (fig. 2)




The illustration shows a grid with NROWS = 8 and NCOLS = 5. The cell size is given in map inches; the system calculates the ground size from the map scale, M SCALE.

Table I lists the commands which define the input elevation data matrix, and specifies which are optional and which are required. The default for optional commands is given.

The system can read the elevation data in a number of different ways. In other words, the format of the data, on cards or tape, is not restricted to one fixed scheme. Therefore, to read the data, the user must specify the format of the data to the system. A number of commands define the format of the data; some of these are required and some, if not specified, cause a default action to take place.

In the simple case in which a data matrix has been punched onto cards by rows, with the lower (most southerly) row on the first card or cards, the user need only specify NROWS, NCOLS, and FORMAT. If elevations have been punched to the nearest 100 feet, with the last two digits omitted from the data, then specifying ZSCALE=100. would cause the program to rescale the elevations to the proper value. All other options would take their default value.

NROWS, NCOLS must be specified. Their product, which is the number of cells in the map, should preferably be less than 60,000 for greatest efficiency. The maximum value of either NROWS or NCOLS is 1000. DELTA X and DELTA Y define the cell size on the map. The default values of one-fifth inch wide by one-sixth inch high will allow the program system to produce maps on a line printer which are exact overlays for the original map; if the values are changed, overlay maps will not be produced.

BY ROWS, BY COLS, ROW RIGHT, ROW LEFT, COL UP, COL DOWN are provided to allow for the fact that different approaches to the problem of digitizing terrain data are equally logical. The default case is BY ROWS, ROW RIGHT, COL UP, which assumes that the data starts on the data medium at the lower left corner, proceeds across the first row to its right, then from left to right across the next row up, etc. If not, choose options that correctly describe the sequence of data points on the data medium. If the number of cells in the map exceeds 60,000, data should be read BY ROWS only; reading it BY COLS will be substantially more expensive in computer time.

BCD is the default and will be the usual case where the data are punched in a form that can be read directly by this system by proper choice of options. If the format of the data is such that reading directly is not possible, the user must write a preprocessor program which will read the data in the user's format and write it in an acceptable format. One such format is binary records, as produced by a Fortran WRITE(IUNIT) list statement. Thus the preprocessor can write the data in this form, and the user can read it into this system by specifying BINARY.

The options mentioned earlier apply here as well as in the BCD case. That is, a binary record may be a row (BY ROWS) or a column (BY COLS). If by rows, the first record may be the lowermost row (COL UP, the default) or the topmost row, in which case the user must specify COL DOWN. The binary data must be in floating point format; this means that the preprocessor must write floating-point numbers.

In some cases the input data matrix may be larger than the memory space in the computer available to the user. If this is the case then the preprocessor should handle the data a row (or a column) at a time with an array dimensioned to the length of a row (or a column) and not for the entire matrix. The VIEWIT system will then automatically handle data matrixes which are larger than available core.

FORMAT is required if the data is BCD. It is a Fortran format, with the enclosing parentheses but without the word "FORMAT," which describes one row or column of the data. More than one card or card image per row or column can be used, so long as the format specifies this. For example, if the data are read by ROWS, and NCOLS=110, with the rightmost digit of the elevations omitted (so elevations are given to the nearest 10 feet and fit in four columns), the following command might describe the data: FORMAT='(5(20F4.0/),10F4.0).' This will cause five cards to be read per row.

The command, FORMAT='(20F4.0)' would also work in that case. (Consult an experienced Fortran programmer if this is confusing.) The

Table 1.--Commands defining input elevation data matrix, optional commands, and defaults

| Command | Meaning | Required or optional | Default |
|---|---|---|---|
| NROWS | Number of rows | Required | --- |
| NCOLS | Number of columns | Required | --- |
| DELTA X | X size of cell (on map) | Optional | DELTAX = 1/6 inch |
| DELTA Y | Y size of cell | Optional | DELTAY = 1/8 inch |
| BY ROWS | Data appears one row per record or records on the data medium | Optional | BY ROWS is assumed if neither BY ROWS nor BY COLS is specified |
| BY COLS | Data appears by columns, one col. per record or records | Optional | |
| BCD | The data is in coded form (cards, or card images on tape or drum) | Optional | BCD is assumed if neither is specified |
| BINARY | The data appears (on tape or drum) with one binary record per row (or per column if BY COLS was specified) | Optional | |
| ROW RIGHT | Each row appears on the data medium from left to right (from west to east, as on the map) | Optional | ROW RIGHT is assumed if neither is specified |
| ROW LEFT | Rows appear on the data medium with the data from right to left (east to west) | Optional | |
| COL UP | Each column appears on the data medium from bottom to top (south to north) | Optional | COL UP is assumed if neither is specified |
| COL DOWN | Columns appear from top to bottom (north to south) | Optional | |
| M SCALE | Map scale | Optional | M SCALE = 24000 |
| FORMAT | A legal Fortran format which will read one row (or one column if BY COLS) of the elevation data from the input medium. The data must be read by F specifications, not I (that is, 3-digit fields must be read as F3.0, not as I3) | Required if data is BCD, ignored if data is BINARY | --- |
| Z SCALE | A multiplier which will be applied to each elevation value read in | Optional | ZSCALE = 1.0 |
| FILE | The name of the Exec-8 file on which the elevation data will be found. This must be cataloged or temporary file attached to the run executing this system. | Optional | The default file name is ZDATA |
| ROTATE | The angle that North makes clockwise of the +Y axis | Optional | ROTATE = 0 |
| MEMORY | The maximum amount of extra memory the VIEWIT system should ask for from the Exec-8 operating system in order to read in the data | Optional | MEMORY = 60000 |

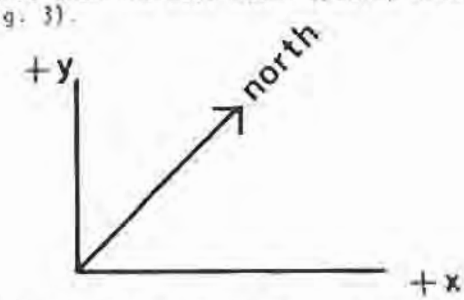
format can be up to 120 characters long if necessary.

Z SCALE allows omission of less-significant digits from the data. In the example just described, Z SCALE = 10. would be specified to rescale the data. That is, 11,417 feet would be punched as 1142. read in as 1142. and scaled to 11420. ZSCALE applies to both binary and BCD data.

FILE is provided to allow the user to have several data files in the same run. In the usual case, the user will simply create a temporary file named ZDATA and place his data cards thereon.

MSCALE is the reciprocal of the map representative fraction. The default of 24000 is correct for 7½-minute maps.

ROTATE is provided in case the data grid is not aligned with the compass directions. The default value (ROTATE=0) means that the positive Y axis of the grid is north. For example, if the direction north actually points between +Y and +X, as the drawing shows, then the user would specify ROTATE=45 (fig. 3).




VIEWIT can handle data grids of any size. However, the computer has a limited amount of memory available. If the data fit into this, then they are all kept in memory. If not, portions of the data (called 'pages') are kept in memory, and other portions are stored on auxiliary storage (disk or drum storage).

This mode of operation involves greater costs for transferring data to and from memory, but lesser memory costs. VIEWIT assumes, as a default value, that it can ask the Exec-8 operating system for up to 60,000 words of extra memory to store the data grid. If the data grid has more than 60,000 cells, the paging mode is used. Depending on the total amount of memory available on the computer for the user and on the relative costs of computation, input/output, and memory, it will sometimes be less expensive to process large data grids by setting the value of MEMORY to some larger number. MEMORY cannot be set larger than the total amount of user memory (if the data grid is this large), or the Exec-8 system will kill the user's job.

The final command relating to reading elevation data is READ. This command is given after all data format specifications have been provided and causes the system to ask for sufficient memory space for the data from the Exec VIII supervisory system. When this space is made available, the data are read in as specified. This process of specifying and reading data can only be done once per program execution. Of course, the program system can be re-executed as many times as desired.

The user should, to summarize, define the extent of the elevation array and its format on the data medium, then cause it to be read. At this point it becomes possible to exercise the analytical options.

### 3.2 Decide on Data Analysis Options

Two principal classes of analysis can be performed with the data. Each has a number of variations. In addition, several other kinds of analyses are available. The two principal options are (a) visibility and (b) slope/aspect analyses. To understand the use of these options and the various displays of their results, the user must understand the method used by the system.

Two fields or values are associated with each cell of the map. One field is elevation, which is read using the commands discussed earlier. The other field is available for each analysis option to place a number in; the significance of the number varies depending on the option chosen.

The user can display a table showing the frequency of occurrence of each value for all cells by the TABLE command. A numeric map showing the contents of the numeric field for each cell can be printed by the MAP command. A gray-scale map of the same information is produced by the GMAP command.

The contents of the numeric field for each cell is initially zero. It can be reset to zero by the user by the CLEAR command. This is sometimes necessary.

The sequence to be followed is: Perform the desired analysis. Then print a table, or a numeric map, or a gray-scale map, or two of these, or all three if desired, in any order. Then erase the numeric information and perform the next analysis. The exception to this is visibility analysis; it may be desirable to perform several of these before printing a table or map.

#### 3.2.1 Data Specification Commands

The following is a list of the data specification commands associated with data analysis:

| Command | Meaning |
|---|---|
| X MIN<br>X MAX<br>Y MIN<br>Y MAX | These four commands taken together define a subrectangle within the data upon which analysis will be performed, and maps and tables will be limited to this subrectangle. The default values are X MIN=1, Y MIN=1, X MAX=NCOLS, Y MAX=NROWS, so that the default subrectangle is the entire data array. The subrectangle can be changed at any time, but changing it after an analysis but before printing a map or table will produce useless results. Well thought out use of these commands will save many dollars in computing when the data matrix is large. |
| TITLE | Specifies a run title of up to 120 characters which will be printed at the top of each page. The default is a blank title. (An example is: TITLE = 'MOUNT RUSHMORE PLANNING UNIT') |
| M TITLE | Specifies a map title of up to 24 characters which will be printed in large block letters before each map. It is printed in two lines of 12 characters each including blanks. The default is 24 blanks. Both TITLE and MTITLE can be changed whenever desired. (An example of MTITLE is: MTITLE = 'TRUCKEE UNITSLOPE MAP.' This instruction will result in the printing of the first 12 characters which are TRUCKEE UNIT on the first line and the second line will then contain the next 9 characters which are SLOPE MAP.) |
| XOBS<br>YOBS | These two commands set an observer point location for visibility analysis. This information must be specified at least once. XOBS and YOBS are in grid co-ordinates. |
| OBS | Serves as an alternative way to specify the observer location. OBS = (22,14) is equivalent to XOBS = 22, Y OBS = 14. |
| RADIUS | Specifies the radius to which visibility will be determined. It is given in miles, and must be specified. |

# APPENDIX I

This appendix shows a simple VIEWIT run in which the data is read directly by the system. The printouts show first, a listing of the cards to be submitted to the computer, just as they would appear in the input deck. This is followed by the actual computer output resulting from the submission of these cards.

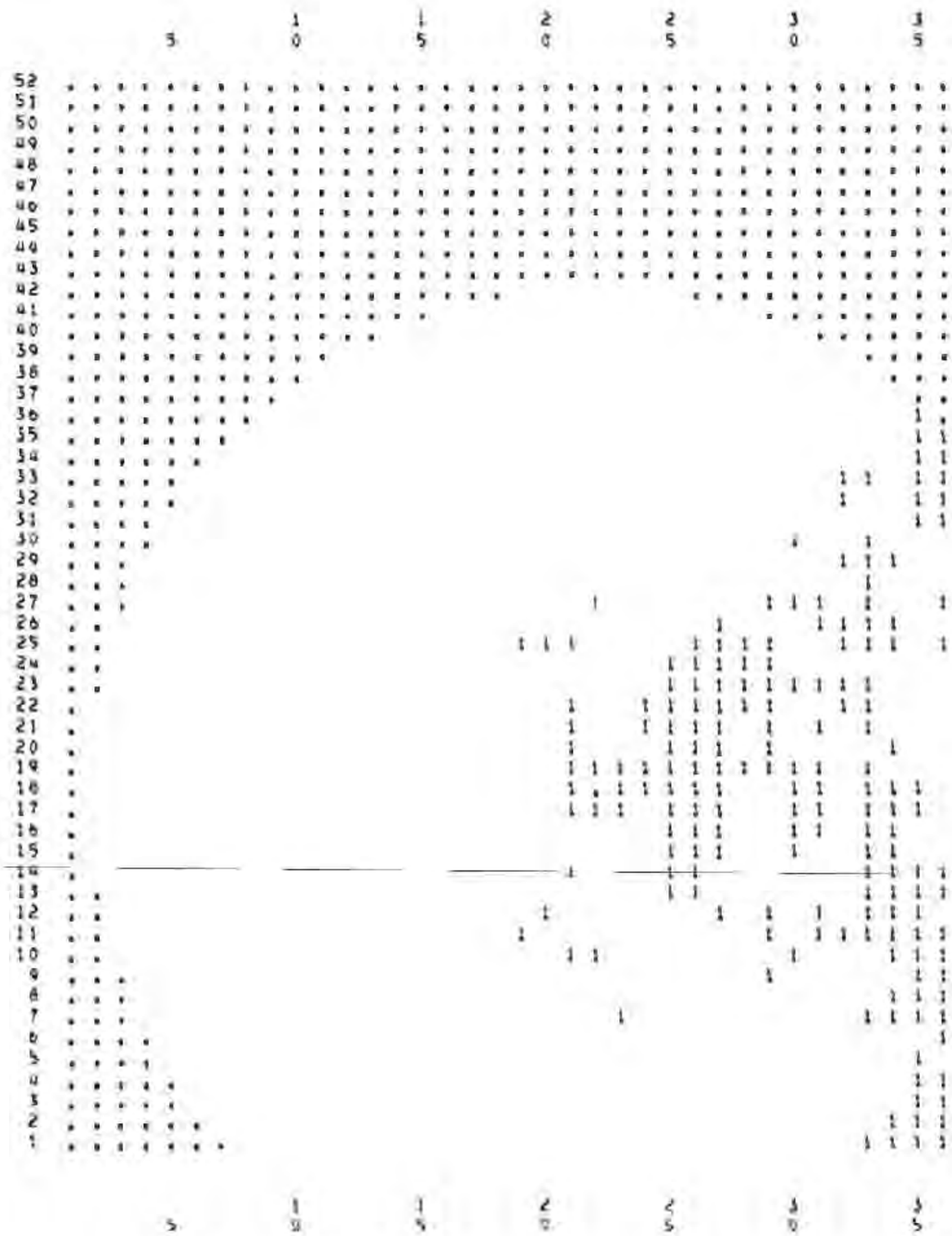
The printouts demonstrate how the elevation data is placed on a file named ZDATA by the use of the @DATA control card. The user commands follow the @XQT card which calls the VIEWIT system into execution. These commands first specify the size and form of the elevation data and cause it to be read. They then perform a number of simple analyses.

```
@HDG ***DEMONSTRATION RUN***
@MSG,N DATA INPUT IS FROM CARDS!
@ASG,T ZDATA,  ,  CREATE A TEMPORARY FILE, 'ZDATA.'
@DATA,I ZDATA,  ,  INSERT DATA CARD IMAGES INTO FILE 'ZDATA.'
*************************
*  DATA CARDS GO HERE *
*************************
@END  ,  THIS CARD IS NEEDED TO STOP @DATA FROM INSERTING CARDS.
@XQT RSW*VIEWIT,   ,   NOW RUN THE VIEWIT SYSTEM
COMMENT='FIRST DEFINE AND READ THE DATA',
NROWS=52, NCOLS=36, ZSCALE=100., FORMAT='(36F2.0)', COL DOWN, READ,
COMMENT='NOTE USE OF ZSCALE TO BRING THE DATA TO THE RIGHT RANGE',
COMMENT='DEFAULTS SUCH AS ROW RIGHT, BCD, MSCALE=24000 HAVE BEEN USED.',
COMMENT='NOW DEFINE AN OBSERVER POINT AND DO A VISIBILITY ANALYSIS',
MTITLE='SEEN AREA$MAP',
OBS=(22,18),RADIUS=1.5, VIEW, COMMENT='NOW PRINT A NUMERIC MAP',
MAP, COMMENT='AND A GREY SCALE MAP', MTITLE='',
MESSAGE='GREY SCALE$SEEN AREA$MAP', GMAP,
COMMENT='ADD A SECOND OBSERVER',OBS=(20,20),VIEW,
MTITLE='TIMES SEEN$MAP',MAP,
COMMENT='NOW WITH THE AVERAGE MAP OPTION INSTEAD.',
AVG MAP, MTITLE='AVERAGE MAP$TIMES SEEN', MAP, MTITLE='',
MESSAGE='GREY SCALE$TIMES SEEN$AVERAGE MAP', GMAP, NUM MAP,
COMMENT='NUM MAP COMMAND SET MAP MODE BACK TO THE DEFAULT OF NUMERIC MAPS OF TIM
ES SEEN',  COMMENT= 'CLEAR COUNT FIELD AND DO A NEW SET OF VISIBILITY ANALYSES.'
, M TITLE='SUBRECTANGLE', CLEAR, X MIN= 10, YMIN=10, YMAX=50,
COMMENT='NOW ALL OPTIONS AFFECT ONLY THIS SUBRECTANGLE.', VIEW, MAP, TABLE,
COMMENT='NOW GO BACK TO THE WHOLE DATA GRID', XMIN=1, YMIN=1, XMAX=36, YMAX=52,
COMMENT='EXAMINE ONLY CERTAIN AZIMUTH SECTORS FOR VISIBILITY',
CLEAR, MTITLE='SECTORS$MAP', SECTOR=(90,180), SECTOR=(225.,315.0), VIEW,
MAP, CLEAR, COMMENT='RESET TO SCAN THE WHOLE CIRCLE', N SECT,
COMMENT='PRINT A CROSS-SECTIONAL PROFILE',  END=(37,52), PROFILE,
MTITLE='SLOPES$MAP', COMMENT='PRINT A SLOPE CLASS MAP', SLOPE, TABLE, MAP, GMAP,
COMMENT='FIND SLOPE CLASSES BY THE MAXIMUM SLOPE METHOD RATHER THAN THE
AVERAGING METHOD USED BEFORE', X SLOPE, TABLE,
MTITLE='MAXIMUM$SLOPE MAP', MAP, GMAP,
COMMENT='AND AN ASPECT MAP BY 10 DEGREE SECTORS', MTITLE='ASPECT$MAP',
ASPECT, MAP, TABLE, COMMENT='NOW COMPASS POINT ASPECT', C ASPECT, TABLE,
MAP, GMAP, COMMENT='AND RELATIVE ASPECT', R ASPECT=180., TABLE, MAP, GMAP,
COMMENT='CHECK CELLS WHICH DIFFER FROM THE AVERAGE OF THEIR NEIGHBORS BY MORE TH
AN 150 FEET.', MTITLE='DATA CHECK$MAP', D CHECK=150, , MAP, GMAP, TABLE,
COMMENT='NOTICE THAT THERE IS ONE ESPECIALLY BAD CELL AT (17,36)',
COMMENT='ITS NEIGHBORS APPEAR IN ERROR ALSO BECAUSE THIS ONE CELL ALTERS THE AVE
RAGE FOR THOSE CELLS.',
COMMENT='PRINT THE ACTUAL ELEVATION DATA',MESSAGE='ELEVATION$MAP', DPRINT,
XOBS=22, YOBS=18,COMMENT='THIS IS AN ALTERNATIVE WAY TO SET OBSERVER POSITION',
COMMENT='DEMONSTRATE WEIGHTED VIEW OPTIONS',MTITLE='WEIGHTED$MAP',
AWON, VIEW, MAP, TABLE, A=OFF, COMMENT='DEFINE DISTANCE WEIGHTING FUNCTION',
NO DWTP, Y POINT=(0.5, 1.), TPOINT=(1.0, 0.5), CLEAR, D = ON, VIEW, MAP, TABLE,
CLEAR,COMMENT='NOW BOTH WEIGHTING METHODS',A = ON,VIEW,MAP,A = OFF, D = OFF,
COMMENT='DEFINE SOME SLOPE CLASSES.',
CLASS(1)=(0.,25.), CLASS(2)=(25.,50.),CLASS(3)=(50,1000.), N CLASS=3,
COMMENT='FOR SLOPE, CLASSES ARE TAKEN AS SLOPES IN PERCENT',
MTITLE='USER SLOPES$MAP',
U SLOPE, TABLE, MAP,
COMMENT='NOW CALCULATE SLOPE BY THE MAXIMUM SLOPE METHOD', U X SLOPE,
TABLE, MAP,
M TITLE='ELEVATION$CLASS MAP',
COMMENT='DEFINE SOME ELEVATION CLASSES', CLASS(1)=(0,4000), CLASS(2)=(4000,5000)
, CLASS(3)=(5000,6000), CLASS(4)=(6000,7000), CLASS(5)=(7000, 10000), NCLASS=
5, U ELEV, TABLE, MAP,
COMMENT='DEFINE ASPECT SECTORS AND ANALYZE ASPECT BY THEM',
CLASS(1)=(350., 360.), CLASS(2)=(0, 10), NCLASS=2,
COMMENT='ASPECTS OUTSIDE THE DEFINED CLASSES WILL BE PUT IN CLASS ZERO',
MTITLE='USER$ASPECTS',
U ASPECT, TABLE, MAP,
COMMENT='END OF DEMONSTRATION OF VIEWIT.', STOP,
@ FIN
@@
```

```
@HDG ***DEMONSTRATION RUN***


@MSG,N DATA INPUT IS FROM CARDS:


@ASG,T ZDATA. . CREATE A TEMPORARY FILE, 'ZDATA.'


@DATA,I ZDATA. . INSERT DATA CARD IMAGES INTO FILE 'ZDATA.'
DATA T7 RL70-5 05/12-11:45:33
END DATA. IMAGE COUNT: 52


@XQT PS**VIEWIT. . NOW RUN THE VIEWIT SYSTEM


#   #  ###  #####  #   #  ###  #####
#   #   #   #      #   #   #     #
#   #   #   ####   # # #   #     #
 # #    #   #      ## ##   #     #
  #    ###  #####  #   #  ###    #



GENERAL VISIBILITY PROGRAM

FOREST RECREATION AND LANDSCAPE MANAGEMENT PROJECT
PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. FOREST SERVICE, BERKELEY, CALIFORNIA

RUN ON 05/14/75 AT 09:30:25

== INPUT CARD: COMMENT='FIRST DEFINE AND READ THE DATA',

   USER REQUEST: COMMEN =
FIRST DEFINE AND READ THE DATA

== INPUT CARD: NROWS=52, NCOLS=36, ZSCALE=100., FORMAT='(36F2.0)', COL DOWN, READ.

   USER REQUEST: NROWS  =       52
NROWS  SET TO          52
   USER REQUEST: NCOLS  =       36
NCOLS  SET TO          36
   USER REQUEST: ZSCALE =      100
ZSCALE SET TO         100.00000
   USER REQUEST: FORMAT =
(36F2.0)
 DATA FORMAT WILL BE:
(36F2.0)
   USER REQUEST: COLDOW
COLUMNS APPEAR ON THE DATA MEDIUM FROM TOP TO BOTTOM.
   USER REQUEST: READ
DATA HAS BEEN READ INTO   1872 ADDITIONAL DBANK LOCATIONS

SOME PROPERTIES OF THE DATA REGION ARE:
--------------------------------------------

    EACH CELL IS     .20 INCHES (    .51 CM.) WIDE AND
        .17 INCHES (    .42 CM.) HIGH ON THE MAP.

    THIS CORRESPONDS TO A CELL    400.00 FEET (   121.92 METERS) IN ITS EAST-WEST DIMENSION AND
       333.33 FEET (   101.60 METERS) IN ITS NORTH-SOUTH DIMENSION ON THE GROUND.

    EACH CELL HAS AN AREA OF   .0048 SQUARE MILES (      3.06 ACRES,        7.50 HECTARES) ON THE GROUND.

    THE DATA REGION IS       7.20 INCHES (     18.29 CM.) WIDE
       AND        8.67 INCHES (     22.01 CM.) HIGH ON THE MAP.

    THIS CORRESPONDS TO A REGION       2.73 MILES (      4.39 KM.) EAST TO WEST AND
         3.28 MILES (      5.28 KM.) NORTH TO SOUTH ON THE GROUND.

    THE AREA OF THE REGION IS          8.95 SQUARE MILES
      (      5730.03 ACRES.      14159.14 HECTARES) ON THE GROUND.
```

```
** INPUT CARD: COMMENT='NOTE USE OF ZSCALE TO BRING THE DATA TO THE RIGHT RANGE',

   USER REQUEST: COMMEN =
NOTE USE OF ZSCALE TO BRING THE DATA TO THE RIGHT RANGE

** INPUT CARD: COMMENT='DEFAULTS SUCH AS ROW RIGHT, BCD, MSCALE=24000 HAVE BEEN USED.',

   USER REQUEST: COMMEN =
DEFAULTS SUCH AS ROW RIGHT, BCD, MSCALE=24000 HAVE BEEN USED.

** INPUT CARD: COMMENT='NOW DEFINE AN OBSERVER POINT AND DO A VISIBILITY ANALYSIS',

   USER REQUEST: COMMEN =
NOW DEFINE AN OBSERVER POINT AND DO A VISIBILITY ANALYSIS

** INPUT CARD: MTITLE='SEEN AREASMAP',

   USER REQUEST: MTITLE =
SEEN AREA    MAP
MAP TITLE IS: SEEN AREA
              MAP

** INPUT CARD: OBS=(22,18),RADIUS=1.5, VIEW, COMMENT='NOW PRINT A NUMERIC MAP',

   USER REQUEST: OBS     = (      22.00,       18.00)
X OBS SET TO     22  AND Y OBS SET TO      18
   USER REQUEST: RADIUS =           1.50
RADIUS SET TO            1.50000
   USER REQUEST: VIEW

VISIBILITY ANALYSIS WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS:
====================================================================
        X OBS              22
        Y OBS              18
        RADIUS          1.500  (MILES)
                        2.414  (KILOMETERS)
        DELTA X           .20
        DELTA Y           .17
        SCALE        24000.00
        XMIN                1
        XMAX               36
        YMIN                1
        YMAX               52
        ZANGLE         -90.00
        ZBIAS               0
        SECTORS             0


ANALYSIS COMPLETE.
THIS OBSERVER CAN SEE     180 CELLS (     .88 SQUARE MILES.
     563.21 ACRES,    1391.71 HECTARES.)

   USER REQUEST: COMMEN =
NOW PRINT A NUMERIC MAP

** INPUT CARD: MAP, COMMENT='AND A GREY SCALE MAP', MTITLE='',

   USER REQUEST: MAP



 MAP OF TIMES SEEN FOR EACH CELL.
     1 OBSERVER(S)

       . MARKS UNOBSERVED CELLS
     INVISIBLE CELLS ARE BLANK
```

# SEEN AREA MAP



USER REQUEST: COMMEN =
AND A GREY SCALE MAP
USER REQUEST: GMAP

# GREY SCALE

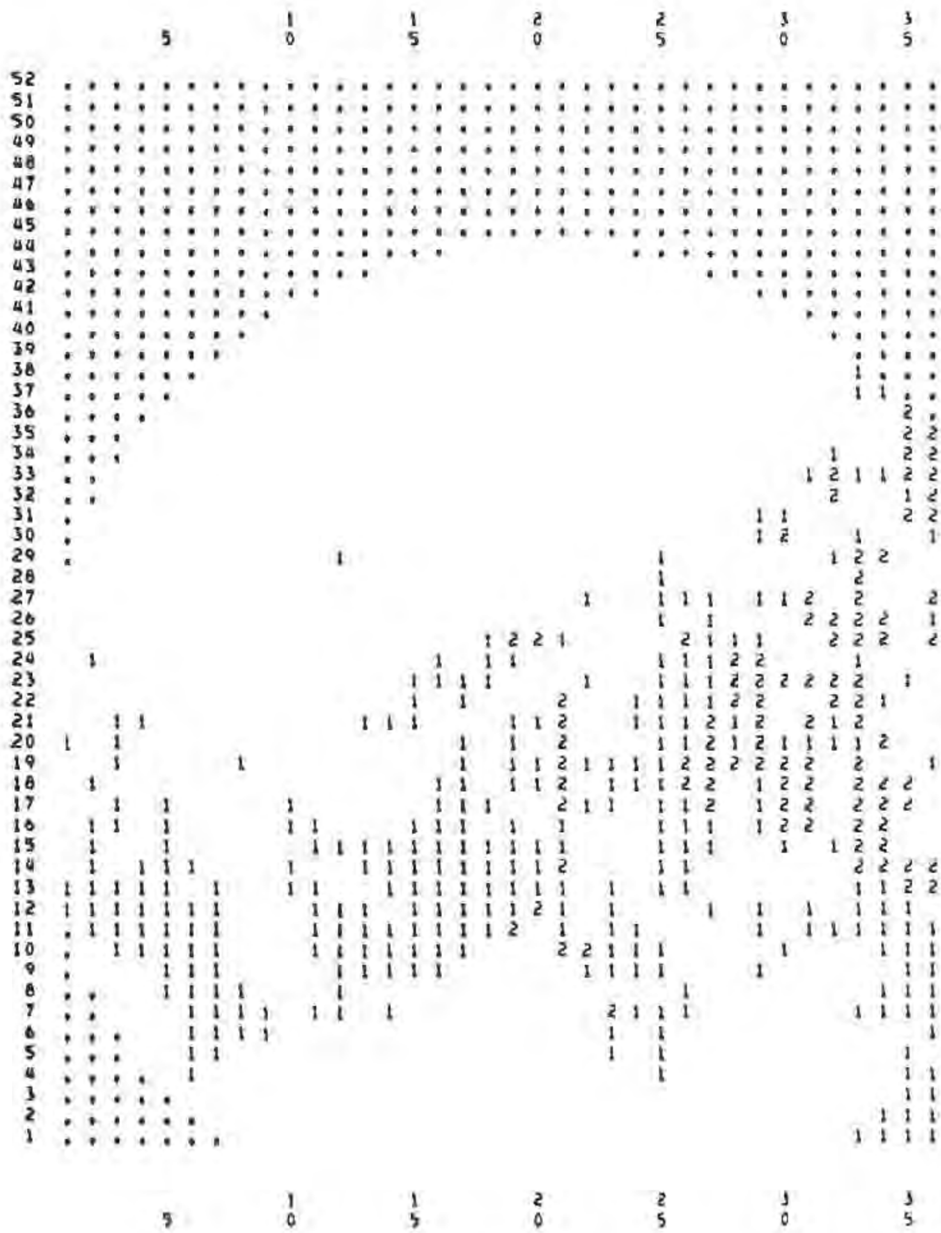
# SEEN AREA MAP

| VALUE | SHADE |
|---|---|
| 0 | |
| 1 | .......... |
| 2 | )))))))))) |
| 3 | ZZZZZZZZZZ |
| 4 | QQQQQQQQQQ |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 OR MORE | |

```
** INPUT CARD;  COMMENT='ADD A SECOND OBSERVER',OBS=(20,20),VIEW,

   USER REQUEST; COMMEN =
ADD A SECOND OBSERVER
   USER REQUEST; OBS     = (       20.00,       20.00)
X OBS SET TO      20  AND Y OBS SET TO      20
   USER REQUEST; VIEW


VISIBILITY ANALYSIS WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS;
====================================================================
         X OBS                  20
         Y OBS                  20
         RADIUS              1.500  (MILES)
                             2.414  (KILOMETERS)
         DELTA X               .20
         DELTA Y               .17
         SCALE            24000.00
         XMIN                    1
         XMAX                   36
         YMIN                    1
         YMAX                   52
         ZANGLE             -90.00
         ZBIAS                   0
         SECTORS                 0


ANALYSIS COMPLETE.
THIS OBSERVER CAN SEE     307 CELLS (    1.47 SQUARE MILES,
     939.70 ACRES,    2322.04 HECTARES.)


** INPUT CARD;  MTITLE='TIMES SEEN$MAP',MAP,

   USER REQUEST; MTITLE =
TIMES SEEN  MAP
MAP TITLE IS; TIMES SEEN
              MAP
   USER REQUEST; MAP

MAP OF TIMES SEEN FOR EACH CELL.
     2 OBSERVER(S)

       . MARKS UNOBSERVED CELLS
     INVISIBLE CELLS ARE BLANK
```

# TIMES SEEN

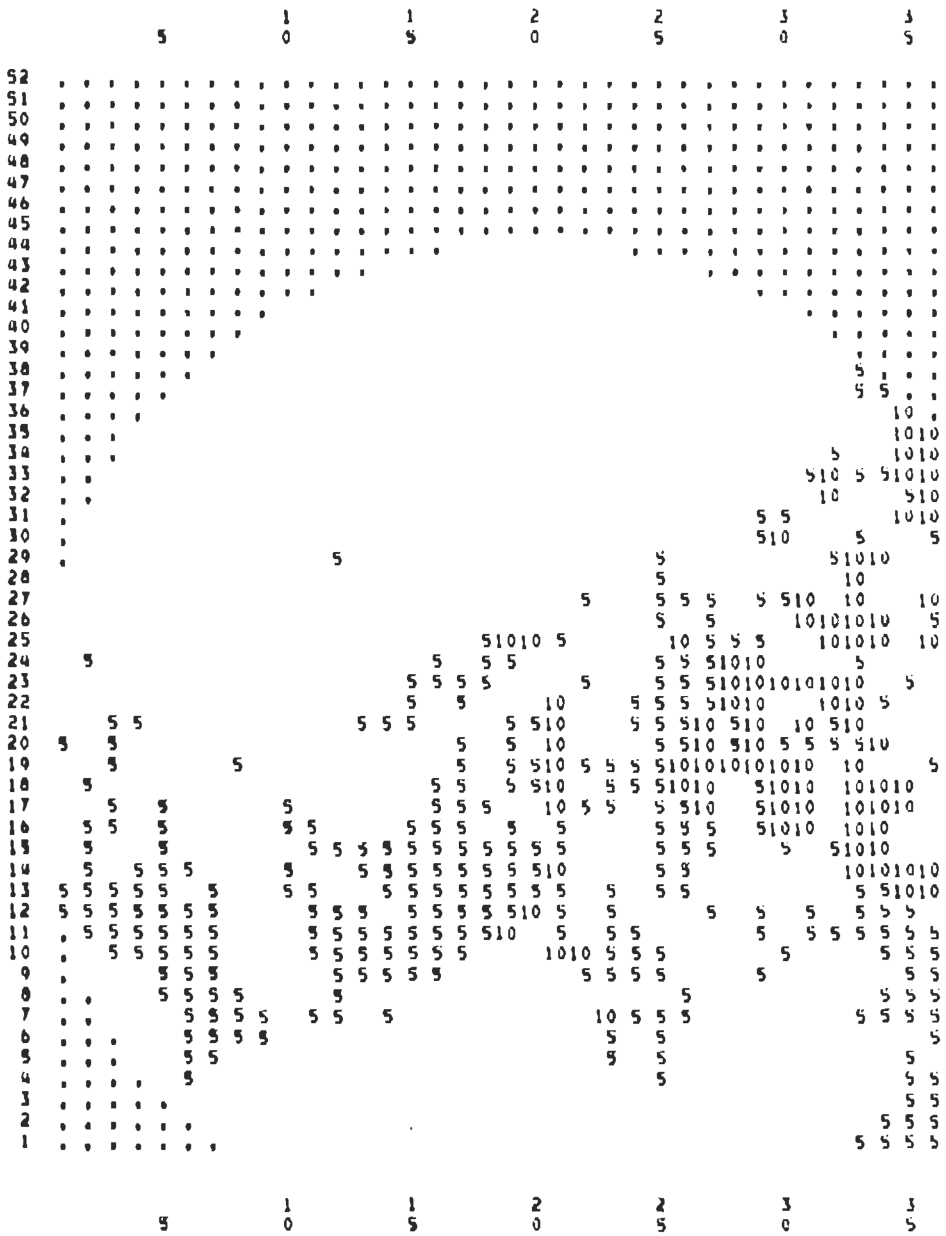
# MAP



```
** INPUT CARD:  COMMENT='NOW WITH THE AVERAGE MAP OPTION INSTEAD.'.

   USER REQUEST: COMMEN =
NOW WITH THE AVERAGE MAP OPTION INSTEAD.

** INPUT CARD:  AVG MAP, MTITLE='AVERAGE MAPSTIMES SEEN', MAP, MTITLE=''.

   USER REQUEST: AVGMAP
VISIBILITY MAPS WILL PRINT TIMES SEEN AS A PERCENT
OF THE NUMBER OF OBSERVERS.
   USER REQUEST: MTITLE =
AVERAGE MAP TIMES SEEN
MAP TITLE IS: AVERAGE MAP
              TIMES SEEN
   USER REQUEST: MAP



MAP OF TIMES SEEN FOR EACH CELL.
     2 OBSERVER(S)

       . MARKS UNOBSERVED CELLS
     INVISIBLE CELLS ARE BLANK

TIMES SEEN IS DISPLAYED AS A PERCENT OF THE NUMBER OF OBSERVERS.
     LESS THAN 10%       BLANK
     10% TO 20%          1
     20% TO 30%          2
     . . .
     100%                10 (SEEN BY ALL OBSERVERS)
```

# AVERAGE MAP

# TIMES SEEN



```
USER REQUEST: GMAP

MAP OF TIMES SEEN FOR EACH CELL,
     2 OBSERVER(S)

      . MARKS UNOBSERVED CELLS
     INVISIBLE CELLS ARE BLANK

TIMES SEEN IS DISPLAYED AS A PERCENT OF THE NUMBER OF OBSERVERS.
    LESS THAN 10%        BLANK
    10% TO 20%           1
    20% TO 30%           2
    . . .
    100%                 10 (SEEN BY ALL OBSERVERS)


GREY SCALE EXPLANATION:

    VALUE          SHADE
    ------------------------------

      0


      1            ..........
                   ..........
                   ..........
                   ..........
      2            ))))))))))
                   ))))))))))
                   ))))))))))
                   ))))))))))
      3            ZZZZZZZZZZ
                   ZZZZZZZZZZ
                   ZZZZZZZZZZ
                   ZZZZZZZZZZ
      4            QQQQQQQQQQ
                   QQQQQQQQQQ
                   QQQQQQQQQQ
                   QQQQQQQQQQ
      5            @@@@@@@@@@
                   @@@@@@@@@@
                   @@@@@@@@@@
                   @@@@@@@@@@
      6            @@@@@@@@@@
                   @@@@@@@@@@
                   @@@@@@@@@@
                   @@@@@@@@@@
      7            @@@@@@@@@@
                   @@@@@@@@@@
                   @@@@@@@@@@
                   @@@@@@@@@@
      8            ##########
                   ##########
                   ##########
                   ##########
      9 OR MORE    ##########
                   ##########
                   ##########
                   ##########
```

# GREY SCALE TIMES SEEN AVERAGE MAP

```
   USER REQUEST; NUMMAP
VISIBILITY MAPS WILL PRINT TIMES SEEN AS A NUMBER.

** INPUT CARD;  COMMENT='NUM MAP COMMAND SET MAP MODE BACK TO THE DEFAULT OF NUMERIC MAPS OF TIM

** INPUT CARD;  ES SEEN'.  COMMENT= 'CLEAR COUNT FIELD AND DO A NEW SET OF VISIBILITY ANALYSES.'

   USER REQUEST; COMMEN =
NUM MAP COMMAND SET MAP MODE BACK TO THE DEFAULT OF NUMERIC MAPS OF TIMES SEEN
   USER REQUEST; COMMEN =
CLEAR COUNT FIELD AND DO A NEW SET OF VISIBILITY ANALYSES.

** INPUT CARD;  , M TITLE='SUBRECTANGLE', CLEAR, X MIN= 10, YMIN=10, YMAX=30,

   USER REQUEST; MTITLE =
SUBRECTANGLE
MAP TITLE IS; SUBRECTANGLE

   USER REQUEST; CLEAR

COUNT FIELD CLEARED FOR CELLS IN THE CURRENT SUBRECTANGLE


   USER REQUEST; XMIN   =      10
XMIN   SET TO         10
   USER REQUEST; YMIN   =      10
YMIN   SET TO         10
   USER REQUEST; YMAX   =      30
YMAX   SET TO         30

** INPUT CARD;  COMMENT='NOW ALL OPTIONS AFFECT ONLY THIS SUBRECTANGLE.', VIEW, MAP, TABLE,

   USER REQUEST; COMMEN =
NOW ALL OPTIONS AFFECT ONLY THIS SUBRECTANGLE.
   USER REQUEST; VIEW


VISIBILITY ANALYSIS WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS;
=====================================================================
        X OBS               20
        Y OBS               20
        RADIUS           1.500  (MILES)
                         2.414  (KILOMETERS)
        DELTA X            .20
        DELTA Y            .17
        SCALE         24000.00
        XMIN                10
        XMAX                36
        YMIN                10
        YMAX                30
        ZANGLE          -90.00
        ZBIAS                0
        SECTORS              0


ANALYSIS COMPLETE.
THIS OBSERVER CAN SEE    203 CELLS (     .97 SQUARE MILES,
    621.36 ACRES,    1535.02 HECTARES.)

   USER REQUEST; MAP



MAP OF TIMES SEEN FOR EACH CELL.
    1 OBSERVER(S)

     . MARKS UNOBSERVED CELLS
    INVISIBLE CELLS ARE BLANK
```

# SUBRECTANGLE

USER REQUEST: TABLE

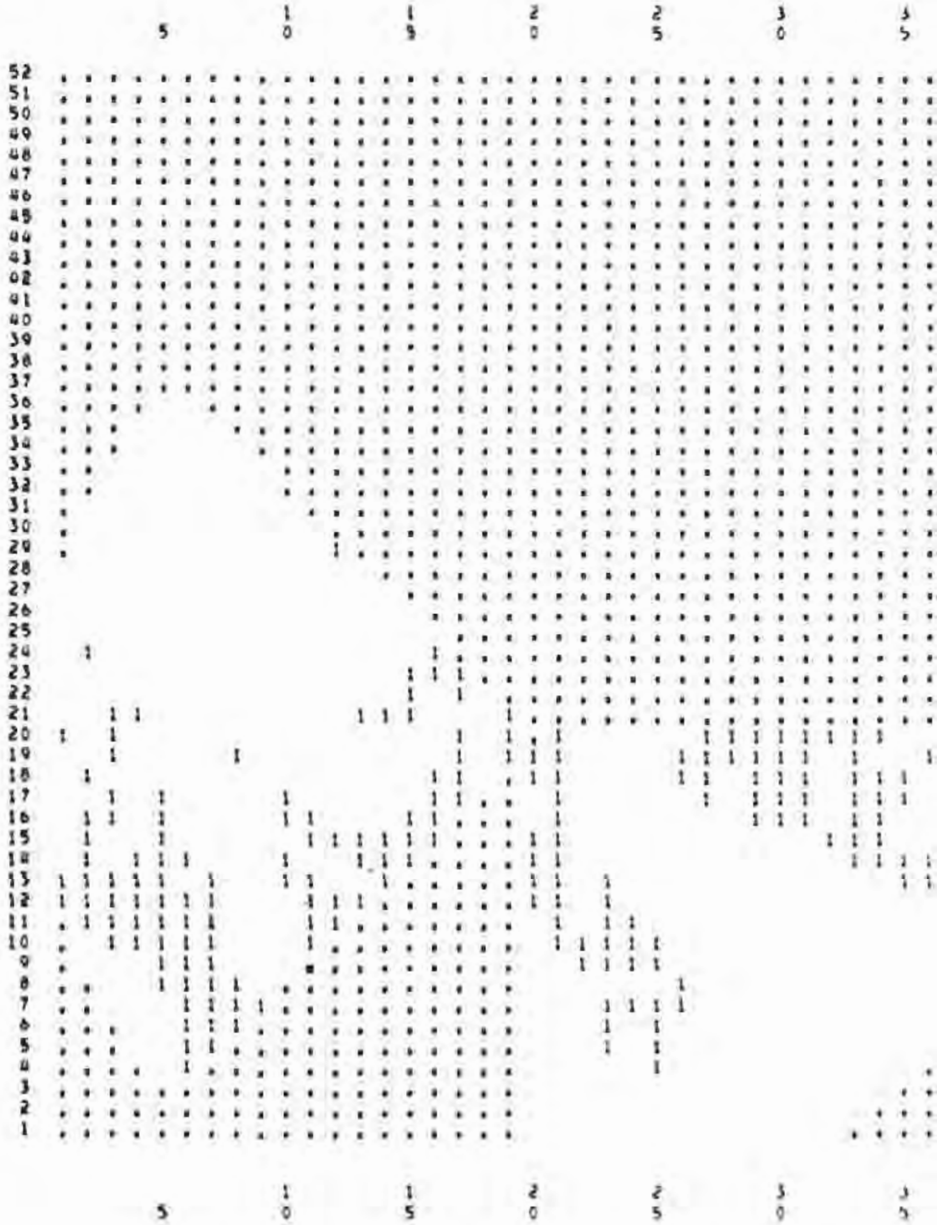
TABLE OF NUMBERS OF CELLS AND AREAS SEEN BY 1 OBSERVER(S).

| TIMES SEEN | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 364 | 1.74 | 1114.17 | 2753.17 |
| 1 | 203 | .97 | 621.56 | 1533.42 |

```
** INPUT CARD:  COMMENT='NOW GO BACK TO THE WHOLE DATA GRID', XMIN=1, YMIN=1, XMAX=36, YMAX=52,

   USER REQUEST: COMMEN =
NOW GO BACK TO THE WHOLE DATA GRID
   USER REQUEST: XMIN    =        1
XMIN    SET TO            1
   USER REQUEST: YMIN    =        1
YMIN    SET TO            1
   USER REQUEST: XMAX    =       36
XMAX    SET TO           36
   USER REQUEST: YMAX    =       52
YMAX    SET TO           52
```

```
** INPUT CARD: COMMENT='EXAMINE ONLY CERTAIN AZIMUTH SECTORS FOR VISIBILITY'.

   USER REQUEST: COMMEN =
EXAMINE ONLY CERTAIN AZIMUTH SECTORS FOR VISIBILITY

** INPUT CARD: CLEAR, MTITLE='SECTOR$MAP', SECTOR=(90,180), SECTOR=(225,,315,0), VIEW.

   USER REQUEST: CLEAR

COUNT FIELD CLEARED FOR CELLS IN THE CURRENT SUBRECTANGLE


   USER REQUEST: MTITLE =
SECTOR      MAP
MAP TITLE IS: SECTOR
              MAP
   USER REQUEST: SECTOR = (      90.00,      180.00)
AZIMUTH SECTOR  1 IS FROM ,      90.00 DEGREES TO      180.00 DEGREES.
   USER REQUEST: SECTOR = (     225.00,      315.00)
AZIMUTH SECTOR  2 IS FROM ,     225.00 DEGREES TO      315.00 DEGREES.
   USER REQUEST: VIEW


VISIBILITY ANALYSIS WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS:
=====================================================================
        X OBS              20
        Y OBS              20
        RADIUS          1.500  (MILES)
                        2.414  (KILOMETERS)
        DELTA X           .20
        DELTA Y           .17
        SCALE        24000.00
        XMIN                1
        XMAX               36
        YMIN                1
        YMAX               52
        ZANGLE         -90.00
        ZBIAS               0
        SECTORS             2
        SECTOR  1     (   90.00,  180.00)
        SECTOR  2     (  225.00,  315.00)

ANALYSIS COMPLETE.
THIS OBSERVER CAN SEE     187 CELLS (     .89 SQUARE MILES,
    572.39 ACRES,    1414.00 HECTARES.)


** INPUT CARD: MAP, CLEAR, COMMENT='RESET TO SCAN THE WHOLE CIRCLE', N SECT.

   USER REQUEST: MAP
```

# SECTOR MAP



USER REQUESTS CLEAR

[illegible]

USER REQUESTS [illegible]
[illegible]
USER REQUESTS [illegible]
[illegible]

[illegible]

USER REQUESTS [illegible]
PRINT A ONE-DIMENSIONAL PROFILE
USER REQUESTS [illegible]
[illegible]
USER REQUESTS PROFILE

ELEVATION PROFILE FROM POINT [illegible] TO POINT [illegible]

[illegible]

ELEVATION IN HUNDREDS OF FEET

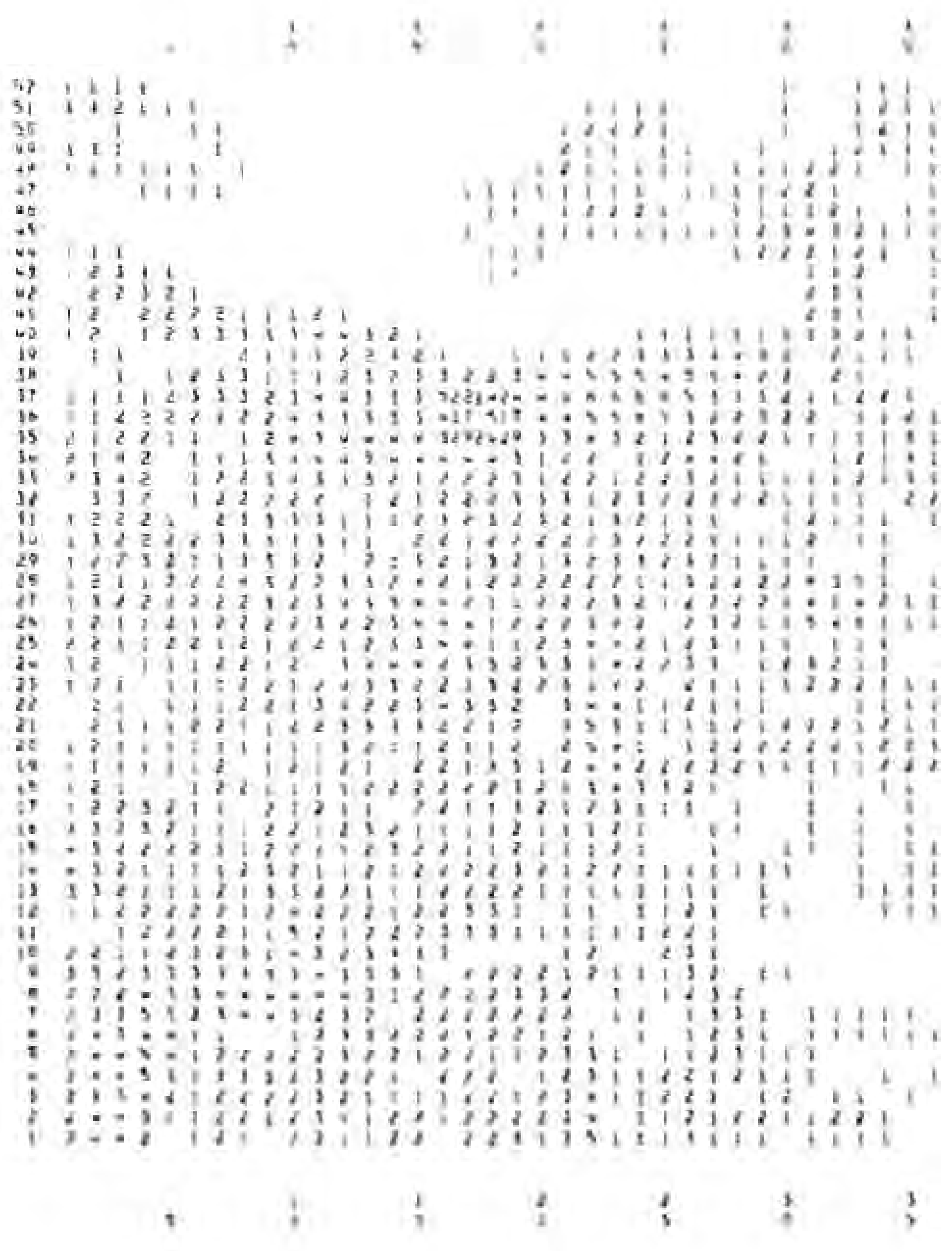
| CELL | COORDINATES ROW | COLUMN | [illegible] |
|---|---|---|---|
| 1 | [illegible] | 20 | [illegible] |
| 2 | [illegible] | 21 | [illegible] |
| 3 | [illegible] | 22 | [illegible] |
| 4 | [illegible] | 23 | [illegible] |
| 5 | [illegible] | [illegible] | [illegible] |
| 6 | [illegible] | 25 | [illegible] |
| 7 | [illegible] | 26 | [illegible] |
| 8 | [illegible] | 27 | [illegible] |
| 9 | [illegible] | 28 | [illegible] |
| 10 | [illegible] | 29 | [illegible] |
| 11 | [illegible] | 30 | [illegible] |
| 12 | [illegible] | 31 | [illegible] |
| 13 | [illegible] | 32 | [illegible] |
| 14 | [illegible] | 33 | [illegible] |
| 15 | [illegible] | 34 | [illegible] |
| 16 | [illegible] | 35 | [illegible] |
| 17 | [illegible] | 36 | [illegible] |
| 18 | [illegible] | 37 | [illegible] |
| 19 | [illegible] | 38 | [illegible] |
| 20 | [illegible] | 39 | [illegible] |
| 21 | [illegible] | 40 | [illegible] |
| 22 | [illegible] | 41 | [illegible] |
| 23 | [illegible] | 42 | [illegible] |
| 24 | [illegible] | 43 | [illegible] |
| 25 | [illegible] | 44 | [illegible] |
| 26 | [illegible] | 45 | [illegible] |
| 27 | [illegible] | 46 | [illegible] |
| 28 | [illegible] | 47 | [illegible] |
| 29 | [illegible] | 48 | [illegible] |
| 30 | [illegible] | 49 | [illegible] |
| 31 | [illegible] | 50 | [illegible] |

```
** INPUT CARD:  MTITLE='SLOPE$MAP', COMMENT='PRINT A SLOPE CLASS MAP', SLOPE, TABLE, MAP, GMAP,

   USER REQUEST: MTITLE =
SLOPE       MAP
MAP TITLE IS: SLOPE
              MAP
   USER REQUEST: COMMEN =
PRINT A SLOPE CLASS MAP
   USER REQUEST: SLOPE

SLOPE CLASS VALUES CALCULATED FOR CURRENT SUBRECTANGLE.


   USER REQUEST: TABLE


SLOPE CLASS TABLE.
     0 MEANS 0 TO 10% SLOPE.
     1 MEANS 10 TO 20% SLOPE.
     2 MEANS 20 TO 30% SLOPE, ETC.
```

| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 452 | 2.16 | 1383.53 | 3418.77 |
| 1 | 592 | 2.83 | 1812.06 | 4477.68 |
| 2 | 466 | 2.23 | 1426.38 | 3524.66 |
| 3 | 230 | 1.10 | 704.01 | 1739.64 |
| 4 | 94 | .45 | 287.73 | 710.98 |
| 5 | 23 | .11 | 70.40 | 173.96 |
| 6 | 7 | .03 | 21.43 | 52.95 |
| 14 | 1 | .00 | 3.06 | 7.56 |
| 17 | 2 | .01 | 6.12 | 15.13 |
| 22 | 1 | .00 | 3.06 | 7.56 |
| 24 | 2 | .01 | 6.12 | 15.13 |
| 29 | 2 | .01 | 6.12 | 15.13 |

```
   USER REQUEST: MAP




SLOPE CLASS MAP.
     BLANK MEANS 0 TO 10% SLOPE.
     1 MEANS 10 TO 20% SLOPE.
     2 MEANS 20 TO 30% SLOPE, ETC.
```

# SLOPE MAP



USER REQUEST: GMAP

SLOPE CLASS MAP,
BLANK MEANS 0 TO 10% SLOPE,
1 MEANS 10 TO 20% SLOPE,
2 MEANS 20 TO 30% SLOPE, ETC.

# SLOPE MAP

** INPUT CARD: COMMENT='FIND SLOPE CLASSES BY THE MAXIMUM SLOPE METHOD RATHER THAN THE

** INPUT CARD: AVERAGING METHOD USED BEFORE', X SLOPE, TABLE,

USER REQUEST: COMMEN =
FIND SLOPE CLASSES BY THE MAXIMUM SLOPE METHOD RATHER THAN THE AVERAGING METHOD USED BEFORE
USER REQUEST: XSLOPE

MAXIMUM SLOPE CLASS VALUES COMPUTED FOR CURRENT SUBRECTANGLE.

USER REQUEST: TABLE

TABLE OF MAXIMUM SLOPE CLASSES.
0 MEANS 0 TO 10% SLOPE
1 MEANS 10% TO 20% SLOPE, ETC.

| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 227 | 1.09 | 694.83 | 1716.95 |
| 1 | 77 | .37 | 235.69 | 582.40 |
| 2 | 208 | .99 | 636.67 | 1573.24 |
| 3 | 853 | 4.08 | 2610.96 | 6451.79 |
| 5 | 284 | 1.36 | 869.30 | 2148.08 |
| 6 | 181 | .87 | 554.02 | 1369.02 |
| 7 | 14 | .07 | 42.85 | 105.89 |
| 9 | 9 | .04 | 27.55 | 68.07 |
| 10 | 1 | .00 | 3.06 | 7.56 |
| 15 | 1 | .00 | 3.06 | 7.56 |
| 17 | 2 | .01 | 6.12 | 15.13 |
| 19 | 1 | .00 | 3.06 | 7.56 |
| 22 | 1 | .00 | 3.06 | 7.56 |
| 24 | 1 | .00 | 3.06 | 7.56 |
| 25 | 1 | .00 | 3.06 | 7.56 |
| 27 | 2 | .01 | 6.12 | 15.13 |
| 32 | 1 | .00 | 3.06 | 7.56 |
| 34 | 1 | .00 | 3.06 | 7.56 |
| 60 | 2 | .01 | 6.12 | 15.13 |
| 69 OR MORE | 5 | .02 | 15.30 | 37.82 |

** INPUT CARD: MTITLE='MAXIMUM$SLOPE MAP', MAP, GMAP,

USER REQUEST: MTITLE =
MAXIMUM SLOPE MAP
MAP TITLE IS: MAXIMUM
SLOPE MAP
USER REQUEST: MAP

MAP OF MAXIMUM SLOPE CLASSES
BLANK MEANS 0 TO 10% SLOPE
1 MEANS 10% TO 20%, ETC.

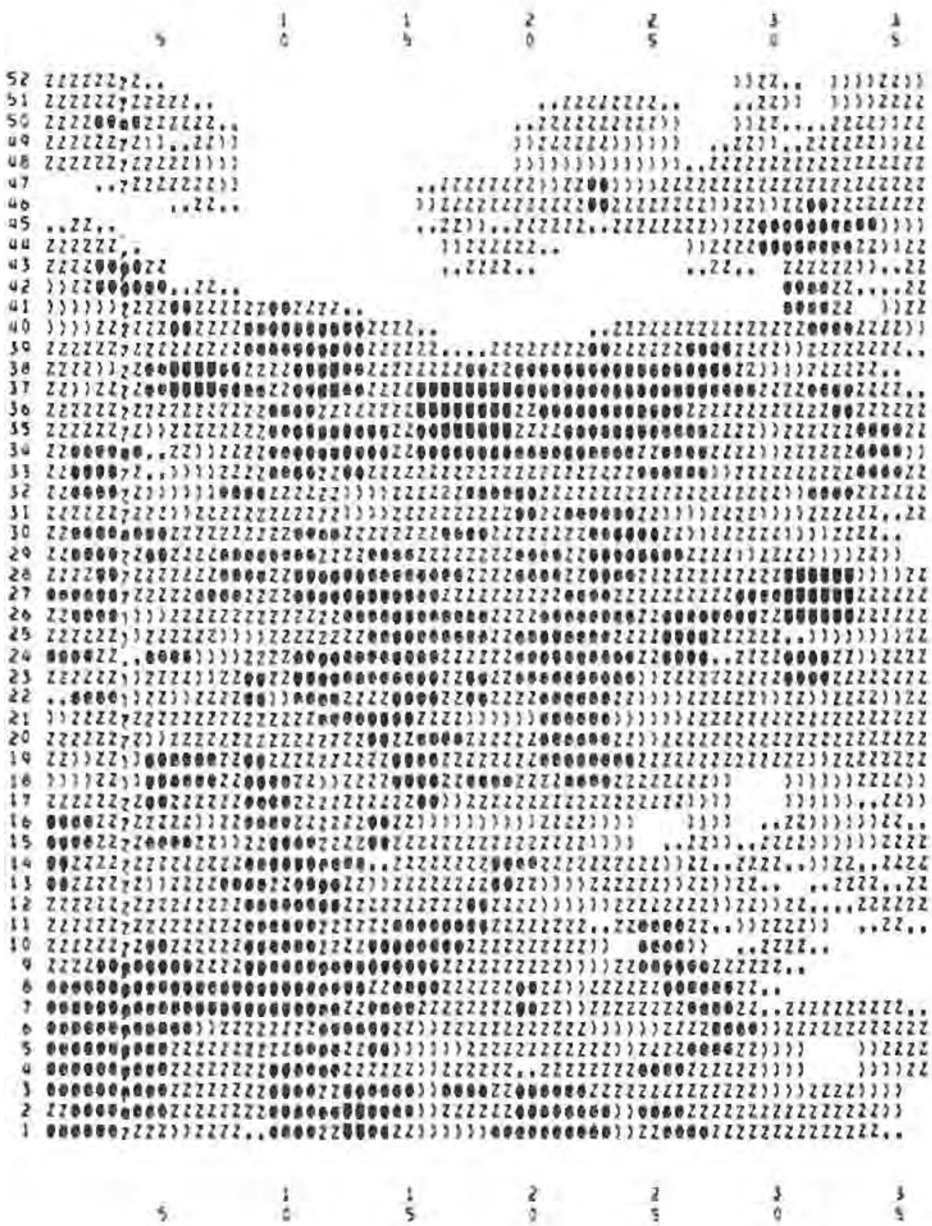
# MAXIMUM SLOPE MAP

```
                      1         1         2         2         3         3
            5         0         5         0         5         0         5

52  3 3 3 3 1                                               2 3 1   2 2 3 2
51  3 3 3 3 3 3 1                           1 3 3 3 3 1     1 3 2   2 2 3 3
50  3 3 5 5 3 3 3 1                       1 3 3 3 3 3 2     2 3 1 1 3 3 2 3
49  3 3 3 3 2 1 3 2                       2 3 3 3 2 2 2   1 3 2 1 3 3 3 2 3
48  3 3 3 3 3 3 2 2                       2 2 2 2 2 2 2 1 3 3 3 3 3 3 3 3 3
47      1 3 3 3 3 2               1 3 3 3 3 2 3 6 2 2 3 3 3 3 3 3 3 3 3 3 3
46            1 3 1               2 3 3 3 3 3 3 6 3 3 3 3 2 3 2 3 6 3 5 3 3
45  1 3 1                         1 3 2 1 3 3 3 1 3 3 3 3 2 3 6 6 6 5 5 2 2
44  3 3 3 1                         2 3 3 3 1           2 3 3 6 6 5 5 3 2 3
43  3 3 6 6 3                       1 3 3 1             1 3 1   3 3 3 2 1 3
42  2 3 6 6 5 1 3 1                                             5 5 3 1 1 3
41  2 2 2 3 3 6 3 3 3 6 3 3 1                                   5 5 3   2 3
40  2 2 3 3 3 6 3 3 5 6 6 6 6 3 3 1             1 3 3 3 3 3 3 3 3 5 5 3 3 2
39  3 3 3 3 3 3 3 3 5 5 6 6 6 3 3 3 1 1 3 3 3 3 6 3 3 3 6 6 3 3 2 3 3 3 3 1
38  3 3 2 3 5 9 9 6 3 3 6 9 5 3 3 3 3 6 3 6 6 6 6 6 6 6 6 6 3 2 2 3 3 3 1
37  3 2 3 3 5 9 9 6 5 3 6 9 5 3 3 972**74 6 6 6 6 6 6 6 6 5 5 3 3 5 6 3 3 1
36  3 3 3 3 3 3 3 3 3 5 6 3 3 3 310******* 3 6 6 6 6 6 6 3 3 3 3 3 3 6 3 3 3
35  3 3 3 3 2 3 3 3 3 5 6 6 6 6 3 680**80 3 3 6 6 6 6 5 5 3 3 2 3 3 3 5 5 3
34  3 5 5 5 1 3 2 3 3 5 6 6 6 6 3 6 6 6 6 5 5 6 5 5 3 5 5 3 3 2 3 3 3 5 5 2
33  3 7 7 3 1 2 2 3 3 5 6 3 6 3 3 3 3 3 3 3 3 3 3 3 5 5 5 2 3 3 3 3 3 5 5 3
32  3 5 5 3 2 2 2 5 5 3 3 3 2 2 3 3 3 5 5 6 3 3 3 3 3 3 3 3 3 3 2 5 5 3 3 3
31  3 3 3 3 3 2 3 3 3 3 3 3 2 2 3 3 3 3 3 6 3 5 5 5 3 2 2 3 3 2 2 3 3 3 1 3
30  3 5 5 5 6 3 3 3 1 3 5 5 3 3 3 3 5 5 3 3 3 3 5 6 6 3 2 3 3 3 2 2 3 3 1
29  3 5 6 3 6 3 3 5 5 5 5 3 3 5 5 3 3 3 3 5 5 3 6 6 6 5 3 3 2 3 3 2 2 3 2
28  3 3 6 3 3 3 3 5 5 3 6 6 6 5 5 5 5 3 3 5 5 3 6 5 3 3 3 3 3 3152417 2 2 3
27  5 5 6 3 3 3 5 5 3 3 6 6 6 7 7 5 3 3 3 3 3 5 5 3 3 3 3 3 6 5222725 3 3 3
26  3 5 5 2 2 3 3 3 3 3 3 3 5 5 6 5 5 5 3 3 5 5 5 5 3 6 5 5 6 3172719 3 3 3
25  3 3 3 2 3 3 3 2 2 3 3 3 3 5 6 5 5 5 3 5 6 5 5 3 3 7 7 3 3 3 1 2 2 2 2 3
24  5 5 3 1 5 5 2 2 3 3 5 6 5 5 6 5 3 3 3 5 6 5 5 5 3 6 7 1 3 3 6 6 3 2 3 3
23  3 3 3 2 3 3 2 3 6 3 7 7 5 5 5 6 3 6 3 5 5 5 5 5 2 3 3 3 3 3 6 6 3 3 3 3
22  1 5 5 2 3 2 3 3 6 2 5 5 3 3 6 6 3 6 3 3 5 5 5 3 2 2 3 3 3 2 3 2 3 3 2 3
21  2 3 3 3 3 3 3 3 3 3 3 5 5 6 6 3 3 2 2 2 5 5 5 2 2 2 3 3 3 3 3 3 3 3 3 3
20  3 3 3 3 2 3 3 3 3 3 3 3 3 6 3 5 5 3 3 3 5 5 5 3 2 3 3 3 3 3 3 3 3 3 3 3
19  3 2 3 2 6 5 5 3 6 3 3 3 3 3 6 5 3 3 3 3 5 5 5 5 3 3 3 3 3 3 3 2 3 3 3 3
18  2 2 3 2 6 5 5 3 6 5 3 2 3 3 7 7 3 5 5 3 3 5 5 3 3 3 3 2     2 2 2 3 3 2
17  3 3 3 3 6 3 3 3 5 5 3 3 3 3 3 6 2 3 3 3 3 3 3 3 3 3 2 2     2 2 2 1 3 2
16  6 5 3 3 3 3 2 3 5 5 3 3 3 6 3 2 2 2 2 2 3 3 2 2     2 2   1 3 2 2 2 3 1
15  6 5 3 3 5 5 3 2 3 6 5 3 3 6 3 3 3 3 3 3 3 3 2 2   1 3 2 1 3 3 2 2 2 3 3
14  6 3 3 3 3 3 3 3 5 6 6 5 5 1 3 3 3 3 6 5 3 3 3 3 3 2 3 1 3 3 1 2 3 1 3 3
13  6 3 3 3 2 3 3 5 5 3 6 6 3 2 3 3 3 3 6 3 2 2 3 3 3 2 3 2 3 1   1 3 3 1 3
12  3 3 3 3 3 3 3 3 5 5 5 6 3 3 3 3 3 6 3 3 2 2 2 3 3 3 3 2 3 2 3 1 1 3 3 3
11  3 3 3 3 3 3 3 3 5 5 5 3 3 3 5 5 6 6 3 3 3 3 1 3 5 5 3 1 2 3 3 2   1 3 1
10  3 3 3 3 6 3 3 3 6 5 5 3 3 6 6 5 6 3 3 3 3 3 2   5 5 2   1 3 3 1
 9  3 3 6 5 6 6 3 3 6 5 5 5 6 6 6 6 3 3 3 3 3 2 2 3 5 6 5 3 3 3 1
 8  5 5 7 7 5 6 6 6 6 6 6 5 6 3 5 6 3 3 3 6 3 2 3 3 3 6 5 5 3 1
 7  5 5 6 5 5 5 6 6 6 6 6 9 3 5 5 3 3 3 3 6 3 2 3 3 3 3 5 5 3 1 3 3 3 3 3 1
 6  5 5 5 5 5 5 2 3 3 3 3 5 5 6 3 2 3 3 3 3 3 3 2 2 2 3 3 5 5 2 3 3 3 3 3 3
 5  5 5 5 5 5 3 3 3 3 3 5 5 3 6 2 2 2 3 3 3 3 3 3 2 3 3 5 5 3 2 2     2 3 3
 4  5 5 5 5 5 3 3 3 3 6 5 5 3 3 3 2 3 3 3 1 3 3 3 3 5 5 3 3 3 2 2     2 2 3
 3  5 5 5 5 5 3 3 3 3 6 5 3 6 5 5 2 5 5 3 6 5 5 3 3 3 3 3 3 3 2 2 3 3 2 2
 2  3 5 5 5 5 3 3 3 3 5 5 5 9 7 5 2 3 3 3 6 5 5 5 2 5 5 3 3 3 3 3 3 3 3 2
 1  5 5 5 3 3 2 3 3 1 5 5 3 9 5 3 2 2 2 5 5 5 5 2 3 5 5 3 3 3 3 3 3 3 3 1

                      1         1         2         2         3         3
            5         0         5         0         5         0         5
```

USER REQUEST: GMAP

MAP OF MAXIMUM SLOPE CLASSES
BLANK MEANS 0 TO 10% SLOPE
Z MEANS 10% TO 20%, ETC.

# MAXIMUM SLOPE MAP



```
** INPUT CARD: ASPECT, MAP, TABLE, COMMENT=(NOA COMPASS POINT ASPECT), C ASPECT, TABLE,

   USER REQUEST: ASPECT

ASPECT CLASS VALUES COMPUTED FOR CURRENT SUBRECTANGLE.

   USER REQUEST: MAP

ASPECT CLASS MAP.
     36 ASPECT CLASSES:
     1 MEANS 0 TO 10 DEGREES.
     2 MEANS 10 TO 20 DEGREES.
     ETC.
     BLANK CELLS HAVE NO ASPECT (ARE FLAT).

ASPECT MAP

                   1         1         2         2         3         3
         5         0         5         0         5         0         5

52  1 1 1 3 4                                                  242522  28293031
51  1 1 3 3 1 3 4                            3334 1 1 3 4      282828  28293134
50      12 933 2 4 4                        333335 1 2 4 6     31303333313031 31
49 1818 10 831 4 7 6                        313033 4 6 9 9   33303133333232 2822
48 18181831212113 9                         282828 9 9 9 933333333434333 3222121
47      22211820 1613                 3334 1 13320201616 6 435333334335 1283133
46           221815                   283134 1 12118181816 15282828282117 20283333
45 33 1 4                             2225201515171616211818222120201818 24282828
44 35 1 4 4                             2422171515           20211619182528292422
43 3435 2 4 4                           22211615             221815  313031312221
42 3132 1 5 5 1 1 4                                                   2929313315 16
41 2828    9 536 1 43535 2 3 4                                        262726   1315
40 282628 8 235 2 43535 1 2 3 2 3 4            3334 1 1 1 1 1 328262318 1513
39 332522 9 131 6 53433 3 3 3 1 2 4 43334 1 1353536 13636 1 2 433272418 1615
38  428263 33434 2 4 13134 3 4 1 3 4 1353536 1363536 13636 3 5 615262416 22
37 1518262 83234 1 4 13035 2 2 1 3 11318233536 3535 1 136 1 6 7 6 72420192222
36 1618242 52525 16 8 13334 3 4 1 236 8 229343 53535 1 1 2 6 9 8 5 4 4 1822 2633
35 1620273 9282424 3353234 2 2 1 134 4 13335333335 2 4 91113 1211 6 4 4312933
34 1724283 028252833333233 2 2 2 135 1 1 3 2302 820 13 15 13 13 14 1313 4 6 7292828
33 1826273 622282830 313233 1 4 5 13336 4 6 3312615 1514 1110 8 4 3 3 9 1124 2022
32 3128273 52428282828272622 9 8343235 5 4 1353511151510 7 3 3 4 911 9282320
31 3328273 6262425242322232211 63333 1 6 1 1 1 6101216 11 8 6 6 911 7 4 12821
30 2126253 32220222324262725131829 31 2 535 1 7 9 9 4 3 711 1 5 15 1311 434 4 4
29 2224243 22322262829302829 14222728 1 435 4 6 5 5 3 3 6 7 81113 13 2231 7 6
28 2928293 0303232303 12822 18162427283 1 2 1 6 6 4 6 7 8 8 6 5 7 614 2024 8 634
27 2829323 3313 1302826201818 1923 2525 2834 4 6 7 8111313 15 12121212 9 43329 5 335
26 3128262 626262525231818 19232525262831 5 6 81012 14 15 1110 1313 12 43532 6 234
25 3331313 52025262624 1517242830302928 26 11 12 12 12 12 13 18 13 1111 4 6 42828 9 928
24 2829313 028282826 18152430 32323231 2622 17 14 12 11 10 12 18 1413   1 2 13535 6 918
23 2025243 12828242 11 18 17 3030 31 29 26 2121201911 9 91011 13 11 93335 3 234 1 4 4 2
22 2828283 025242218182528 2825 2320 19 21 2223 9 910 1111 9 8 33334 8  31 3 6 6 3
21 2826242 122212121 3030 28 2622 20 20 22 26 2828    9 9 9 9 9 63534 1 3 134 1 5 4 1
20 2124222 2212222631 51 28 24 2422 21 28 29 28 24 24 24 9 8 8 8 6 13536 1 1 135 1 4 2 1
19 2224252 120242824 22 22 22 24 26 24 29 25 20 22 24 24 9 8 8 5 23535 2 1 1 4 134 3 3 2
18 2828283 8  2624202429 33 28 25 23 23 22 18 23 25 24 15 9 7 4 135 1 6      9  31 3 4 4
17 2931333 5 13428283031 34 34 28 24 23 25 21 26 26 23 16 9 8 4 134 6 9      9  2815 1215
16 3432343 3 1 431312928 31 3635 34 34 28 25 28 28 26 16 13 11 9     9 9 1512222813 1215
15 3433343 3 3 53331302928 2033 1 1333333303 1 4 8 9 9  1512131515152428 6 4 1
14 3535351 3 6 4353230323 1262633 13534343333 4 5 3 4 3 4121315 1515 2425  3 1
13  13634 1 6 1 13528303534 31303334343333234 8 8 6 4 4 6 7 6 9 9  22222 21816
12  2 134 2 335 1 3292832363 43331333 53334 4 9 9 6 4 6 8 9 6 7 3 1 42222 1817
11 183133 2 236 2 629282833335363232353635 3 6 6 4 3 7 91215 6 6 4 9  221815
10 2023261 3 1 1 2 4342929313 43535 333315 18 1 4 7 6   9 9 9   9131515
 9 2222232 733 1 3 33631293 03335 22423162021 1511 1116 9 8 71317 1515
 8 2526282 83036 3 2 134313131341217 1516 18201913 8 6 3 5 6 81315
 7 2829301 03034 3 2 1363128281310 14 18 17 18222328 6 4 1 7 8 7 615 1618 18 182122
 6 2426282 92929 9 913 17232 8221613 11 15 16 17222424 13 913 1211 9 913 1518 18212 118
 5 2828282 82722 15 17 17 1625252 11815 911 1518 21 22221813 11 13 14 1111 9 9    3131 1
 4 3129282 827 1815 1617 182524 182222 8 8 918202324201614 1413 9 6 8 9   2831 3
 3 3029282 825 1614 1517 222528 1622221 1 911 1618 2222522 1513 13 16 9 6 6 634 3312 8
 2 3130302 925 1513 14 1520 2826 15212 418 1110 13 16232624 9 910 16 18 1511 3435 2 131
 1 2929302 928 1312 13 15262822 15202615 9 91012272828 9 8 911 18 15132913 4 433

                   1         1         2         2         3         3
         5         0         5         0         5         0         5
```

USER REQUEST: TABLE

ASPECT CLASS TABLE,
36 ASPECT CLASSES:
1 MEANS 0 TO 10 DEGREES,
2 MEANS 10 TO 20 DEGREES,
ETC.
ZERO CELLS HAVE NO ASPECT (ARE FLAT).

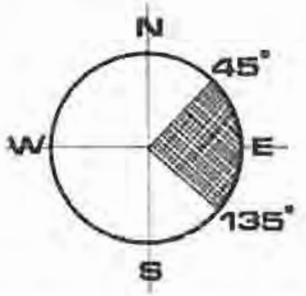
| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 237 | 1,13 | 725,44 | 1792,58 |
| 1 | 107 | ,51 | 327,52 | 809,31 |
| 2 | 43 | ,21 | 131,62 | 325,24 |
| 3 | 51 | ,24 | 156,11 | 385,75 |
| 4 | 79 | ,38 | 241,81 | 597,53 |
| 5 | 20 | ,10 | 61,22 | 151,27 |
| 6 | 56 | ,27 | 171,41 | 423,56 |
| 7 | 21 | ,10 | 64,28 | 158,84 |
| 8 | 38 | ,18 | 116,31 | 287,42 |
| 9 | 78 | ,37 | 238,75 | 589,96 |
| 10 | 12 | ,06 | 36,73 | 90,76 |
| 11 | 37 | ,18 | 113,25 | 279,85 |
| 12 | 25 | ,12 | 76,52 | 189,09 |
| 13 | 46 | ,22 | 140,80 | 347,93 |
| 14 | 13 | ,06 | 39,79 | 98,33 |
| 15 | 63 | ,30 | 192,84 | 476,51 |
| 16 | 34 | ,16 | 104,07 | 257,16 |
| 17 | 17 | ,08 | 52,04 | 128,58 |
| 18 | 65 | ,31 | 198,96 | 491,64 |
| 19 | 7 | ,03 | 21,43 | 52,95 |
| 20 | 25 | ,12 | 76,52 | 189,09 |
| 21 | 35 | ,17 | 107,13 | 264,73 |
| 22 | 70 | ,33 | 214,26 | 529,46 |
| 23 | 23 | ,11 | 70,40 | 173,96 |
| 24 | 60 | ,29 | 183,65 | 453,82 |
| 25 | 39 | ,19 | 119,38 | 294,98 |
| 26 | 47 | ,22 | 143,86 | 355,49 |
| 27 | 14 | ,07 | 42,85 | 105,89 |
| 28 | 128 | ,61 | 391,80 | 968,15 |
| 29 | 41 | ,20 | 125,50 | 310,11 |
| 30 | 37 | ,18 | 113,25 | 279,85 |
| 31 | 64 | ,31 | 195,90 | 484,07 |
| 32 | 21 | ,10 | 64,28 | 158,84 |
| 33 | 79 | ,38 | 241,81 | 597,53 |
| 34 | 57 | ,27 | 174,47 | 431,13 |
| 35 | 60 | ,29 | 183,65 | 453,82 |
| 36 | 23 | ,11 | 70,40 | 173,96 |

```
   USER REQUEST: COMMEN =
NOW COMPASS POINT ASPECT
   USER REQUEST: CASPEC

ASPECT CLASSES BY PRINCIPAL COMPASS DIRECTIONS CALCULATED
FOR THE CURRENT SUBRECTANGLE,


   USER REQUEST: TABLE


TABLE OF ASPECTS BY PRINCIPAL COMPASS DIRECTIONS,
     THERE ARE 8 ASPECT CLASSES,  EACH REPRESENTS A 45 DEGREE
    WIDE RANGE CENTERED ON A COMPASS POINT:
       1          +-22,5 DEG, FROM NORTH
       2          +-22,5 DEG, FROM NE
       3          +-22,5 DEG, FROM EAST
       4          +-22,5 DEG, FROM SE
       5          +-22,5 DEG, FROM SOUTH
       6          +-22,5 DEG, FROM SW
       7          +-22,5 DEG, FROM WEST
       8          +-22,5 DEG, FROM NW
       ZERO       NO ASPECT (FLAT)
```

| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 237 | 1,13 | 725,44 | 1792,58 |
| 1 | 234 | 1,12 | 716,25 | 1769,89 |
| 2 | 216 | 1,03 | 661,10 | 1633,75 |
| 3 | 190 | ,91 | 581,57 | 1437,09 |
| 4 | 166 | ,79 | 508,11 | 1255,57 |
| 5 | 114 | ,55 | 348,94 | 862,26 |
| 6 | 205 | ,98 | 627,49 | 1550,55 |
| 7 | 266 | 1,27 | 814,20 | 2011,93 |
| 8 | 244 | 1,17 | 746,80 | 1845,53 |

```
** INPUT CARD: MAP, GMAP, COMMENT='AND RELATIVE ASPECT', R ASPECT=180,, TABLE, MAP, GMAP,

   USER REQUEST: MAP




MAP OF ASPECT BY PRINCIPAL COMPASS DIRECTIONS,
     THERE ARE 8 ASPECT CLASSES,  EACH REPRESENTS A 45 DEGREE
    WIDE RANGE CENTERED ON A COMPASS POINT:
       1          +-22,5 DEG, FROM NORTH
       2          +-22,5 DEG, FROM NE
       3          +-22,5 DEG, FROM EAST
       4          +-22,5 DEG, FROM SE
       5          +-22,5 DEG, FROM SOUTH
       6          +-22,5 DEG, FROM SW
       7          +-22,5 DEG, FROM WEST
       8          +-22,5 DEG, FROM NW
       BLANK      NO ASPECT(FLAT)
```

| Command | Meaning |
| --- | --- |
| NSECT | Disables the azimuth sector feature of visibility analysis. It should be given to turn this feature off or to define a new set of sectors. The default is to examine the full circle. |
| SECTOR | Specifies the start and end, in degrees clockwise from North, of an azimuth sector in which visibility analysis is to be performed. Up to 20 such sectors may be defined by successive sector commands. For example, to limit the visibility analysis to the directions from NE to SE, specify: N SECT, SECTOR = (45,135) (fig. 4) |




to return to examining the whole circle, specify N SECT alone.

| Command | Meaning |
| --- | --- |
| Z ANGLE | Specifies a <u>vertical</u> angle in degrees relative to the horizontal below which it is assumed that the <u>observer</u> cannot see or which is not appropriate for this analysis. For example, stating Z ANGLE = 0 will have the effect of making all cells at a lower elevation than the observer visible. Z ANGLE can be from -90° to +90°. The default value is -90°, which places no restriction on visibility. |
| Z BIAS | Specifies a distance in feet which is added to the observer point elevation for visibility analysis. This can be used, for example, to simulate fire towers, tops of tramways, tops of power transmission towers, airplane or helicopter views. The Z BIAS may be negative to indicate surface excavation. The default value is zero. |
| X END<br>Y END<br>END | These commands specify the end point of the line along which profiles will be drawn by the PROFILE command. Profiles begin at the current observer point as set by OBS (or X OBS, Y OBS). To draw a profile (cross-section of the elevation data) from point (13,43) to point (51,20), the user could specify: OBS=(13,43), END=(51,20), PROFILE, |
| NO D W T P | Sets the distance weight function to a standard weight of 1.0 for all distances. It would normally only be needed to redefine the distance weight function. |
| T POINT | Specifies a pair of numbers which represent a "turning point" of the distance weight curve. The first number is the distance in miles from the observer, and the second is a weight between 0 and 1.0. The user can define distance weighting functions with up to 20 turning points. The program connects these points with straight line segments. A weight of 1.0 at a distance of 0. from the observer and a weight equal to the last given weight at a distance of infinity are assumed. Turning points must be specified in order of increasing distance. |
| A W ON | Enables weighting by relative aspect in visibility maps. Normally, cells are simply counted as seen or not seen. With weighted visibility (by aspect or distance or both), cells which are seen are given from 0 to 10 points depending *on the weighting function.* |
| A W OFF | Turns off weighting by relative aspect. |
| D W ON | Enables weighting visibility by distance, according to the current distance weight function. |
| D W OFF | Turns off distance weighting. (Initially both relative aspect and distance weighting are off.) |

| Command | Meaning |
|---|---|
| CLEAR | Sets to zero the contents of the numeric field for each cell in the current subrectangle. The CLEAR command should be used between each type of analysis in the same run. (For example, the numeric field should be cleared between a SLOPE analysis and a VIEW analysis.) |
| CLASS | Defines arbitrary classes called 'user classes' that can be used to do slope class, aspect class, or elevation class analyses. |
| N CLASS | Specifies the number of user-defined classes to use in a user-class analysis (U SLOPE, U ASPECT, U ELEV, or UX SLOPE). |
| SHOW NZ<br>HIDE NZ | These two commands control the printing of small but nonzero values in grey-scale maps. The default is HIDE NZ; specifying SHOW NZ will cause small values to print as the lightest shade of gray |
| HI ANGLE | Specifies an upper limit to an observer's angle of view. The default value of HI ANGLE is +90 degrees |
| LO ANGLE | Serves as synonym for Z ANGLE. Either command may be used to set a vertical angle below which the observer cannot see |
| RANK | Specifies a weight associated with an observer point. The default RANK is 1 |
| MAXIMUM<br>AVERAGE | Weighted visibility is normally averaged over all observers. If this averaging is undesirable, the maximum over a set of observers may be kept by specifying MAXIMUM. The default state of averaging may be reinstated by specifying AVERAGE |

### 3.2.2 Analysis Commands

The following commands cause various analyses to be performed:

| Command | Action |
|---|---|
| SLOPE | Calculates slope class number for each cell and places it in the numeric field for that cell. |
| ASPECT | Calculates an aspect class number and stores it for each cell. This option gives 36 classes, each 10 degrees wide, for the greatest resolution of aspect. |
| C ASPECT | Calculates aspect in eight 45-degree wide classes, each centered on a major compass direction. It provides less resolution than the ASPECT option, but is more useful for some purposes. |
| R ASPECT | Calculates and stores, for each cell, a number showing the cell's aspect relative to the specified direction. There are eight 22.5-degree wide sectors on each side of the given direction. The two sides are treated alike (this is not the case for the ASPECT or C ASPECT options). For example, this may be thought of as a sun-illumination analysis if the given angle is the sun's direction or as northeast aspect map if R ASPECT = 45. |
| D CHECK | Tests each cell to see if it differs from the average of its eight closest neighbors by more than the tolerance given. If so, a count of the number of times the difference exceeds the given amount is placed in the numeric field. Cells which are greatly different from their neighbors are probably in error. (Normally it is efficient to check the data for gross errors with a large tolerance before using smaller values.) |
| VIEW | Performs a visibility analysis according to the current parameters. The important parameters are observer positions, (OBS), RADIUS, the number of sectors and their positions, Z ANGLE, Z BIAS, and whether or not relative aspect or distance weighting is enabled. For nonweighted visibility either 0 or 1 is added to the numeric field of each cell. For weighted visibility, an integer from 0 to 10 is added. Thus the contents of each numeric field are accumulated over any number of visibility analyses, and indicate either times seen or weighted times seen. Since these numbers are added, the command CLEAR should be given before beginning a series of visibility analyses to zero the numeric field for each cell. Otherwise, the user may be adding, for example, times |

| Command | Meaning |
|---|---|
| | seen to slope class, giving a nonsensical result.<br><br>Like all other analytical and output options, VIEW acts on only the current subrectangle. |
| U SLOPE | Causes the VIEWIT system to perform a slope class analysis using user-defined classes. |
| U ASPECT | Causes an aspect class analysis to be performed using user-defined classes. |
| U ELEV | Causes the system to classify elevations by the user-defined classes. |

For U SLOPE, the contents of the user-defined classes are interpreted as slopes in percent (for example, 100.0 means a 45-degree slope). For U ASPECT, the numbers are interpreted as compass directions (0 to 360) in degrees. For U ELEV, the numbers are interpreted as elevations in feet.

| | |
|---|---|
| X SLOPE | Calculates slope class numbers using a nonaveraging method of calculating slope. |
| U X SLOPE | Calculates slope class numbers using nonaveraging slope calculation, according to user-specified classes. |

### 3.2.3 Display Option Commands

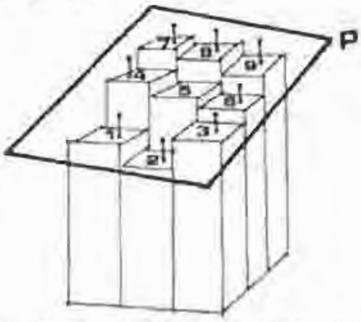
The following commands are for the <u>display options</u>:

| Command | Meaning |
|---|---|
| TABLE | Prints a table showing the distribution of the contents of the numeric field of all cells in the current subrectangle. An appropriate explanatory heading is printed, depending on the operation last performed on the data. (The user will probably find this option useful for all of the types of analyses.) |
| MAP | Prints a numeric map of the contents of the count field for each cell in the current subrectangle. The numbers may be slope class, times seen, etc., depending on the last operation performed. An appropriate heading is printed. |
| AVG MAP | Causes subsequent MAP commands to print maps of times seen with each cell's value presented as a percent of the numbers of observers. This is especially useful if there are 10 or more observer points. |
| NUM MAP | Cancels the AVG MAP command and returns the MAP command to the default mode of printing the actual number of times seen for each cell. |
| G MAP | Prints a gray-shaded map of the numeric field of each cell. This gives the same information as the MAP command in a form which is more understandable as a whole, especially when seen from a distance. |
| D PRINT | Causes the actual elevations of each cell in the current subrectangle to be printed in a coded form. This is useful primarily for data checking. |
| PROFILE | Prints a cross-section or profile of the elevation data from the current observer point to the current end point. The cross-section is not to scale (it has exaggerated vertical scale) but is useful for data checking or for getting a sense of the shape of the terrain or for determining high or low points on a specified route for further view analysis. |
| STATS<br>EL STATS<br>V STATS | These three commands print tables of statistical information about the current subrectangle. The table is for examined cells in the current subrectangle for the STATS command, for visible cells for the V STATS command, and for elevations for the EL STATS command. |

### 3.2.4 Description of Analysis Options

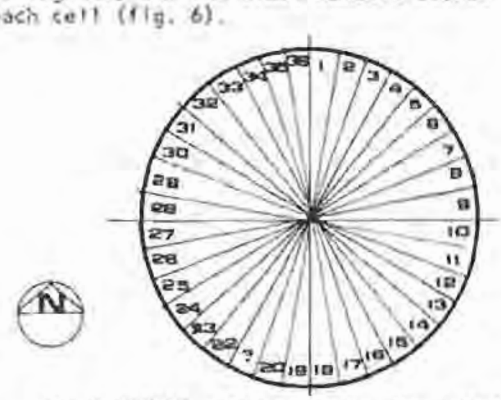
The following sections explain the analysis options in more detail.

SLOPE calculates the slope of each cell by fitting a plane surface to its eight nearest neighbors. This plane is a 'best fit' in the sense that it minimizes the sum of (distances from the plane to the cells) squared. Slope classes are 10 percent each, so that a slope of 0 to 10 percent is the first class, 10 to 20 percent is the second class, and so forth. Slope class numbers are stored in the numeric field for each cell where they can be examined with one or another of the printout options (fig. 5).

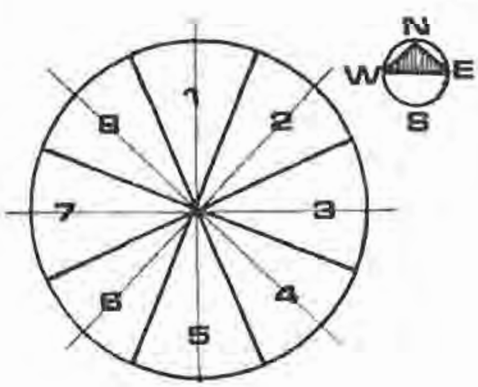



Cell 5 is the cell whose slope is wanted. A plane P is chosen through 5 so that the sum of the squares of the distances from the centers of each of the eight surrounding cells to the plane (drawn above as short vertical lines) is a minimum. The slope of the plane is the slope for the center cell.

Each of the aspect options starts by first finding the best-fit plane at each cell, as the diagram above. Then, the aspect of the cell is the direction in which this plane slopes most rapidly. (A cell with no slope does not have an aspect at all.) For ASPECT, the aspects are divided into 36 classes (each 10 degrees) and the class numbers stored for each cell (fig. 6).

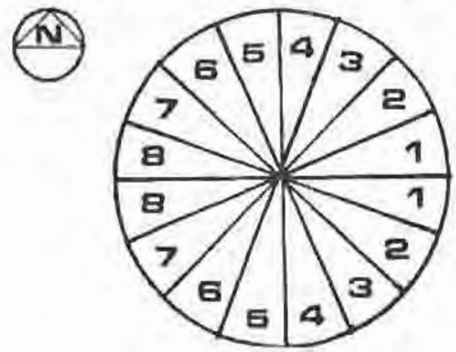



The C ASPECT option divides the circle into eight 45-degree sectors centered on the principal compass points. The class numbers can be printed with TABLE, MAP or G MAP (fig. 7).




This option would be used chiefly to develop shaded maps to indicate aspect by traditional sectors of direction.

The R ASPECT option requires that the user specify a direction (in degrees from north) and calculates the aspect of each cell relative to the given direction. Angles an equal distance on either side of the given direction are treated alike. There are eight classes, each 22.5° wide, from the given angle on either side to opposite the given angle. The following diagram shows the division of the circle into relative aspect classes assuming the user has specified R ASPECT = 90 (fig. 8).




This option would be used mainly to develop weighting of cells from most desirable to least desirable aspects, such as, northeast for snow retention or optimum vegetative regeneration, southeast for campgrounds (early morning sun and protection from late afternoon sun).

The information developed by R ASPECT can be displayed with TABLE, MAP or G MAP. The G MAP display is especially useful with this aspect option. (Gray-scale maps with the other aspect options are not satisfactory because the mind does not want to see the darkest class as being just next to the lightest class.) In particular, a map of the information from the R ASPECT analysis can be considered to be an approximate sun-illumination map of the area under consideration, where the direction specified by the user is the sun's azimuth. (Shading of one cell by another is not considered in this analysis--only the aspect of each cell.)

For both R ASPECT and C ASPECT, class zero is used for cells with no aspect.

Different investigators may have different ideas as to what constitutes a good set of slope or aspect classes. Therefore, the capability of user-defined classes has been added to VIEWIT. These classes can be used for slope, aspect or elevation analysis. To use this option, first define the classes. There can be up to 50 user-defined classes. The user who intends to print gray-shaded maps should not define more than nine classes, however, because only that many distinct shades of gray can be produced. (All numbers from 9 on up will print as the darkest shade.)

Classes are defined by use of the CLASS command. This has a form that is slightly different from other commands, in that it takes a 'subscript' (a number specifying which class is being defined) after the word 'CLASS.' The following is an example of the definition of some classes that might be used for slope analysis:

CLASS(1)=(0,35),CLASS(2)=(35.,100.),CLASS(3)=(100,1000),NCLASS=3,

This example specifies that the first user class is from 0 to 35, the second from 35 to 100, and the third from 100 to 1000. It is also necessary to specify NCLASS--this tells VIEWIT to use the first NCLASS classes (in the example, 3) to do its analyses, maps and tables.

The CLASS command simply accepts any pair of numbers as a value for the specified class. The interpretation of the numbers depends on the analysis to be performed. For slope, the numbers are interpreted as slopes in percent. If the classes defined in the example above were used for slope class analysis, cells whose slope fell between 0 and 35 percent would be given a slope class number of 1, cells with slopes between 35 and 100 percent a class number of 2, and so forth.

For aspect, the class numbers are interpreted as compass directions in degrees. For example, to pick out cells whose aspect was mostly north, the following commands might be used:

CLASS(1)=(350,360),CLASS(2)=(0,10),NCLASS=2, U ASPECT,MAP,

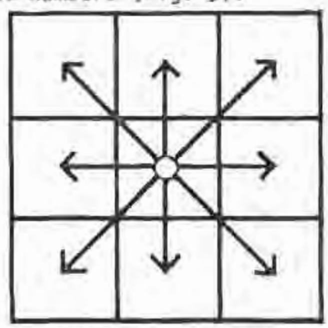
All cells with aspects in the range 350 to 360 degrees would be given a class number of 1, all cells from 0 to 10 degrees, a class number of 2, and all other cells would be given the default class number of zero (which means 'not in any defined class').

For elevation class analysis, the class numbers are taken to be elevations in feet. The following example shows how a user might pick out a band of elevations and break it into several subbands:

CLASS(1)=(5000,5500),CLASS(2)=(5500,6000), CLASS(3)=(6000,6500),NCLASS=3,U ELEV,TABLE, MAP,

These examples illustrate a number of points about class values. Each class has two values associated with it, which are taken to be the lower and upper limit of the class. So, the second number should be larger than the first (no check is made for this, but a class defined backwards will never be found to have anything in it). Classes need not be defined in increasing order, and there may be gaps between them. Classes may overlap, but if they do, a cell will be assigned to the lowest-numbered class in which it falls. Cells which do not fall in any of the first NCLASS classes will be given a class number of zero, which will print as '0' on the map produced by the MAP command, or as a blank on the GMAP gray-scale map.

For some uses, such as soil stability analyses, the method of calculating slope with a best-fit plane over nine cells averages out too much detail in the terrain. For such cases, the maximum slope analysis option, XSLOPE, may be used. This option calculates the slope from a cell to each of the eight surrounding cells, and keeps the largest of these eight numbers (fig. 9).



This slope is then placed in one of the standard 10% slope classes. Alternatively, the U X SLOPE option calculates a maximum slope as shown previously, and then classifies it according to the current set of user-specified classes.

The XSLOPE and U X SLOPE analyses give what is essentially a worst-case slope classification.

For example, assume that three logging techniques are available. The first is applicable to flat and nearly flat terrain, the second to moderate slopes, and the third to steep slopes. The following commands will isolate each of these slope classes and print a map:

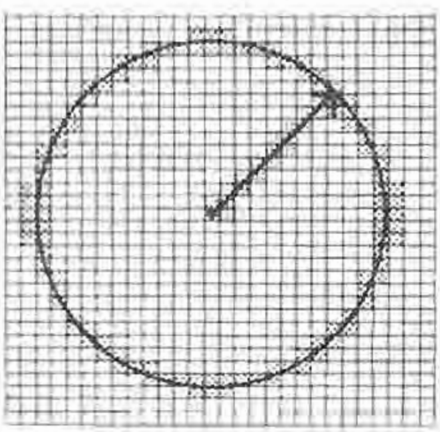
CLASS(1)=(0,10),CLASS(2)=(10,25),CLASS(3)=(25,1000),NCLASS=3, U X SLOPE, MAP,

The data check option, D CHECK, calculates the average elevation of the eight cells around each cell. If the elevation of the cell differs from this average (either by being higher or lower) by more than the value specified by the user, a class number is stored for that cell. For example, if the user gave the command, DCHECK = 200., then cells whose elevations were within 200 feet of the average of their neighbors would have their numeric fields filled with a zero. Cells whose elevations differed by 200 to 400 feet would receive a 1, by 400 to 600 feet a 2, and so forth. These numbers can be displayed with TABLE, MAP, or G MAP. Depending on the precision with which the data was gathered, cells with a large difference class number should be suspected of having incorrect elevations. They should then be checked against the original topographic map to determine if an error was made in digitization.

VIEW may be the most important analysis capability for most users of this system. It produces visibility information that can be displayed as a seen area map, visible frequency map, or weighted visibility map, depending on the options chosen.

This option determines visibility as follows: A circle of radius RADIUS as specified by the user is formed around the defined observer point. From the observer point, a ray is created out through the intervening cells to each point on the rim of the circle. Since the elevation of each cell on this ray and its distance from the observer are known, the elevation/depression angle relative to the observer can be calculated. Only when this is equal to or greater than the angle for any preceding cell on the ray can the cell in question be seen.

A diagram illustrates a matrix of data with an observer point, circle, and one ray (fig. 10).

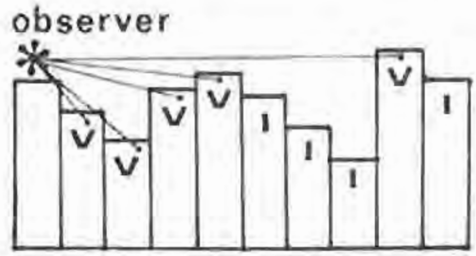


(Although this illustration shows the circle lying entirely within the data, the system does not require this and it may be partially or entirely outside the current subrectangle or even the data matrix.)

Elevations along a ray are determined and some cells are shown to be visible and some not (fig. 11).

In the simplest case of the VIEW analysis, when a cell is visible the system adds 1 to the contents of the numeric field for that cell. Assume, for example, that the user issues the commands:

CLEAR,OBS=(12,32),RADIUS=1.25,VIEW,OBS=(13,35), VIEW,TABLE,MAP,




The CLEAR ensures that the numeric field has all zeroes. Then an observer position is defined and a visibility analysis performed for a radius of $1\frac{1}{4}$ miles. The user could have printed a table or map here, but elected to perform another analysis for a new observer position. Since the radius of examination was not changed, it remained at 1.25 miles for the second analysis.

After the second VIEW command, each cell's numeric field could be in one of three states: (a) Still containing zero, which indicates that it could be seen by neither observer; (b) containing 1, indicating that it was seen by one; (c) containing 2, indicating that it was seen by both observers. The TABLE command will produce a table showing the number and area of cells seen 0, 1, and 2 times. The MAP command will print a map where each cell will be printed as blank (seen zero times), 1, or 2. Or, if the AVG MAP option has been specified, the MAP command will print a map where each cell will print as blank (invisible), 5 (seen by 50 percent of the observers), or 10 (seen by 100 percent of the observers). In addition, the cells which were outside the defined radius of observation for all observer points will be printed as a '.'. In this simplest case, the map could be called a visible frequency map. Any number of observer points can be combined for one analysis.

A number of options restrict or modify the visibility analysis and affect the form of display of the results:

1. Z ANGLE

   The lower limit on visibility can also be set by specifying LO ANGLE, which has the same meaning as Z ANGLE. An upper limit of visibility can be set by specifying HI ANGLE, a limit above which the observer is not allowed to look. The default, +90 degrees (straight up), is not a limitation. To use this feature, the user should specify 'HI ANGLE = ', followed by an angle between 0 and 90.

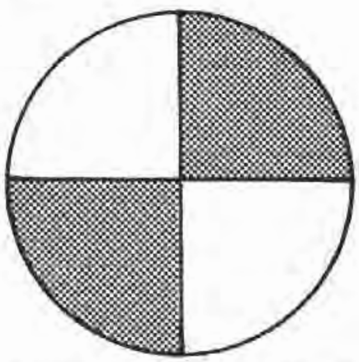
2. Z BIAS can be used to raise or lower the

observer position. The number given by Z BIAS is added to the elevation found in the cell as (X OBS, Y OBS) for the visibility analysis. (The number is not permanently added to the elevation of the specified observer cell.) This option has been used to show the effect on visibility of ski lift towers, aerial tramways, power transmission lines, and similar structures. It may also be used to simulate observation points from airplanes and helicopters.

The N SECT and SECTOR commands can be used to limit the visibility analysis to user-specified azimuth sectors rather than a full 360° circle. N SECT specifies no sectors, which is the default case. It can be used to return from sectored mode to an examination of the entire circle, or to define a new set of sectors. After N SECT is specified, each SECTOR command specifies a pair of numbers which is the start and end azimuth (in degrees from north) of a sector to be examined. There can be up to 20 such sectors. For example, the commands:

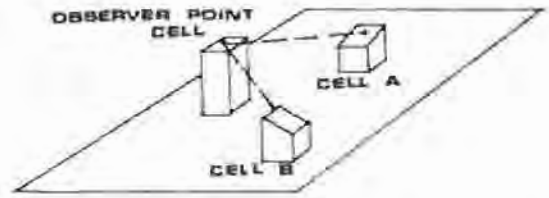
N SECT, SECTOR=(0.,90.), SECTOR = (180.,270.),

will cause all subsequent visibility analyses to be performed only on azimuths from 0 to 90° and from 180° to 270° (i.e., the shaded areas would be examined for visibility and the blank areas would not) (fig. 12).



The Z ANGLE, Z BIAS, and SECTOR options can be used individually or together for any one of several observer points in a series, or for more than one or all. Different observer points can have different values for these options, or the same. The user must only remember that the value specified remains the same until it is changed.

The other set of options for visibility analysis are the weighting options. The first option is weighting by aspect relative to the observer. This function is enabled by A W ON and disabled by A W OFF. Initially it is disabled. With this option, the system calculates the aspect of each cell which is determined to be visible as explained earlier. This aspect is converted to an aspect relative to the observer, taking into account the aspect of the seen cell, elevation of that cell, and elevation of the observer. In most cases, the observer will see the cell somewhat obliquely rather than head-on. Consequently the apparent area of the seen cell will be reduced. Each cell is assigned a maximum of 10 points, and this is scaled according to the relative aspect. That is, if the cell is turned partially away from the observer so that its apparent area is only one-half of its actual area, it receives five points. Cells turned at 90° to the observer, so that they are seen edge-on, and cells which face away from the observer, receive zero points. (Thus zero may indicate cells seen in silhouette that may be of major importance in the analysis of the terrain (fig. 13).)




Cell A is turned at about 45° to the line from the observer in the horizontal plane, and about the same in the vertical plane. It would receive about five points. Cell B is oriented away from the observer and would receive zero points.

The score for each cell, zero to 10, is added to the numeric field for that cell. After weighted visibility analyses have been performed for five observer points, each cell could have a count of zero to 50. A count of 10 could indicate that a cell was seen directly head-on by one observer, and not by others at all, or more likely, that the cell was seen obliquely by several observers.

The numbers developed by this process can be displayed by TABLE or MAP, as before. Because only 10 distinct gray shades are produced on the line-printer, however, a slightly different approach is used for G MAP: The score for each cell is divided by the number of observer points for display purposes. Thus the number displayed by G MAP will always be in the range of zero to 10. This can be considered to be an average of weighted visibility over observers.

Weighted visibility and simple visibility analyses should not be combined in a single series. The system will allow such a combination, but the results will be difficult to interpret. The CLEAR command should always be used between different kinds of analyses.

The Z ANGLE, Z BIAS, and SECTOR options can be used for one or more observer points for weighted visibility analysis, and have the same effects as in the simple case.

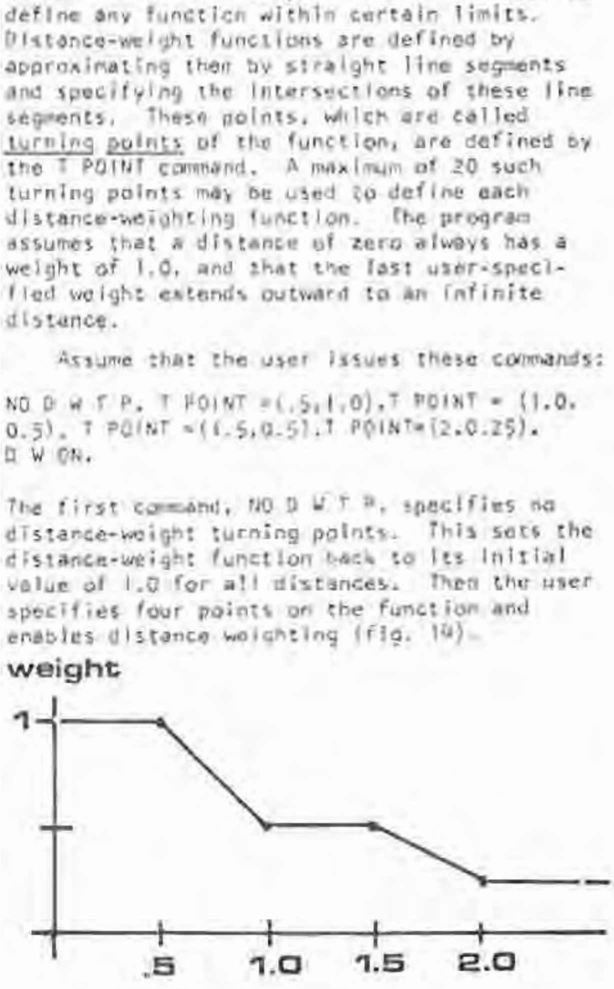
The second kind of weighting is distance weighting. This can be used alone or in combination with relative-aspect weighting. The option allows the visibility of a cell to be weighted by its distance from the observer. To do so, the user must define a distance-weight function which expresses the desired relationship between distance and visibility.

Rather than having a limited set of distance functions, the system allows the user to define any function within certain limits. Distance-weight functions are defined by approximating them by straight line segments and specifying the intersections of these line segments. These points, which are called <u>turning points</u> of the function, are defined by the T POINT command. A maximum of 20 such turning points may be used to define each distance-weighting function. The program assumes that a distance of zero always has a weight of 1.0, and that the last user-specified weight extends outward to an infinite distance.

Assume that the user issues these commands:

NO D W T P, T POINT =(.5,1.0),T POINT = (1.0, 0.5), T POINT =(1.5,0.5),T POINT=(2.0,0.25). D W ON.

The first command, NO D W T P, specifies no distance-weight turning points. This sets the distance-weight function back to its initial value of 1.0 for all distances. Then the user specifies four points on the function and enables distance weighting (Fig. 14).




The line is automatically connected to weight 1 at distance zero and the last weight given is extended outward.

This example also illustrates two rules for the definition of distance-weight functions: (a) weights are numbers between zero and 1.0 inclusive; (b) turning points must be defined from smallest distances to greater distances, otherwise the weighting will not function properly.

When a distance-weight function is defined, D W ON enables weighting by distance. As in relative-aspect weighting, each cell receives a score of zero to 10 points. A weight of 1.0 corresponds to 10 points, a weight of .5 to 5 points, and so forth. This information can be printed with TABLE or MAP, or displayed as an average weighted visibility with G MAP as in the case of relative-aspect weighting.

If the user specifies both relative-aspect and distance weighting, the two weighting processes are carried out independently. Each process produces a number between 0 and 1.0. In the case of relative-aspect weighting, this number is the apparent area of the cell as a fraction of its area if seen head-on. In distance weighting, the number is derived from the user's function. Then these two numbers are multiplied to produce a final weight in the range of 0 to 1.0. This weight is then converted to 10 classes from 1 to 10 and added to the contents of the numeric field of the cell in question.

Either relative-aspect or distance weighting or both can be used for any observer point or points in a series of visibility analyses, but neither should be combined with a simple visibility analysis for the reasons explained earlier. (A series of visibility analyses ends when the user issues a CLEAR command; up to that point numbers accumulate in the numeric fields for each analysis.)

Since GMAP prints the lowest shade of gray for the lowest class, numbers which are below 5 percent will print as blank. Thus, if there are 20 or more observers, or if the total of observer points times observer point ranks exceeds 20, some visible cells will be printed as blank. Where this is undesirable, a new, lighter shade of gray can be printed for cells that are below 5 percent but are nonzero. This option is selected by specifying 'SHOW N Z' for <u>show</u> <u>nonzero</u>. The default case may be restored by specifying 'HIDE N Z'.

At times a user may want to give an observer point greater weight than another such point. To do so, use the 'RANK' command. The default observer rank is 1 (one). If the user specifies, 'RANK = 2, VIEW. ' then cells seen by the observer will have a count of 2 rather than 1 added to the value in their numeric field. The value given by the most recent RANK command is multiplied by whatever might otherwise have been stored in or added to a particular cell. Therefore, if a cell would have received an increment of 5 (for 50 percent) in a weighted visibility analysis, and if the rank is 5, then the cell will receive an increment of 15. A rank will affect all observers until it is changed, so the default must be reset by specifying 'RANK = 1'.

Weighted visibility analyses with more than one observer point average the final weighted visibility over all observers. With scattered observer points, the result may be obscured by averaging them away in some areas. The user can avoid this by specifying 'MAXIMUM'. This will cause the VIEWIT system to keep the maximum of the previous and present values of the count field of a visible cell rather than to add the old and new values and then later average for printout (as is done in the default case).

The default mode can be restored by specifying 'AVERAGE'. The MAXIMUM command, although principally intended for use with weighted visibility, can also be used with nonweighted visibility. Combined with the RANK command, MAXIMUM could be used to label each cell with the rank of the highest-ranked observer point which saw the cell.

The mode of MAXIMUM or AVERAGE can be changed at any time. However, the user should understand the effect this change will have. The mode is checked when a visibility analysis is done, and either a sum or maximum is kept as explained. The mode is also checked for map printout requests, and if the mode at the time of the map command is AVERAGE, the system assumes that the mode was AVERAGE for the visibility analyses as well. It then divides the contents of the numeric field of each cell by the number of observers (in the case of weighted maps, AVG MAP or GMAP). If the mode at the time of the map printout command is MAXIMUM, the system does not perform any division.

Users interested in the statistical properties of their elevation data or analysis results may print out tables of statistical measures by use of the STATS, V STATS and EL STATS commands. The information printed out includes the minimum, maximum, mean, standard deviation, variance, skewness, and kurtosis. This information is printed out for the elevation data in the current subrectangle by specifying 'EL STATS'. The information can be developed and printed out for the count field of cells in the current subrectangle by specifying 'STATS'. If the count field contains the results of one or more visibility analyses, the statistics will only be computed on examined cells. Calculation of statistics can be limited to <u>seen</u> cells alone by specifying 'V STATS'. In other words, V STATS will calculate and print out statistics for cells whose count field is nonzero.

### 3.2.5 Type of Input Expected for Each Command

This system provides for the free-form input of user commands. Commands need not start or end in any particular card column, they may continue across card boundaries, and blanks are usually ignored. Each command is a word of several letters. Certain commands require that the word be set equal to a value. The three types of values are: numbers, strings of characters, and pairs of numbers. An example follows:

```
NROWS=50, NCOLS = 40, BCD, FORMAT = '(40F2.0)',
Z SCALE = 100.0, READ, RADIUS = 1.50, MTITLE =
'SMALL MAP',
OBS=( 12, 33.), VIEW, MAP,          OBS = (12,
34),VIEW,MTITLE = '',MAP,
```

This example defines an elevation array of 50 by 40 locations, specifies that it is in card image form (which is the default and need not have been specified), and that the data are in 40 consecutive two-digit locations on each card. The elevations as read from the cards are to be multiplied by 100. The data are read by using the defaults of BY ROWS, etc. A simple visibility analysis is then performed with the observer at (12,33) and a map of times seen printed with the title SMALL MAP. This analysis is repeated for a new observer.

The example illustrates these points: Certain commands such as BCD and READ expect no value; any value given will be ignored. Other commands expect values of a certain type. Numeric values may have any of the forms NNN, NNN.NNN, .NNN, or any of these preceded by a minus sign. If the program expects an integer, the number given will be rounded to the nearest integer. Character strings are enclosed by single quotes, and only inside the quotes are blanks significant. (Only TITLE, M TITLE FORMAT, FILE and COMMENT expect character string values.) Commands are separated by commas, and extra commas between commands are ignored. Card boundaries are ignored (and as a consequence, the last command on each card <u>must</u> have a trailing comma, or there must be a comma before the first command on the next card, or both). Pairs of numbers are enclosed by parentheses and separated by a comma; otherwise, their form is the same as for numbers standing alone.

Commands may also have a subscript, which is a number in parenthesis following the command name. Currently this is only used by the 'CLASS' command. If a subscript is used with any other command it will be ignored and a warning message printed.

The character '$' has a special function in strings of characters--it acts as a tab to the next set of 12 characters. This is intended for use with the M TITLE and MESSAGE commands. Map titles are printed as two lines of 12 characters each. To print the title USER-CLASS SLOPE MAP on two lines, the user could use the command

```
MTITLE='USER-CLASS  SLOPE MAP',
```

where the two blanks after the word 'CLASS' ensure that the word 'SLOPE' will start on the next line, or more simply, the user could say

```
MTITLE='USER-CLASS$SLOPE MAP',
```

which would save having to count characters.

All user commands, whether they expect a value, and if so what type, are listed here. Because blanks are ignored, the command Z SCALE can be given as ZSCALE or Z S C A L E.

and the command G MAP may be GMAP or G MAP and so forth. The form that is shown is considered most readable.

| Command | Value expected |
|---|---|
| NROWS | number (integer) |
| NCOLS | number (integer) |
| DELTA X | number |
| DELTA Y | number |
| H SCALE | number |
| X MIN | number (integer) |
| X MAX | number (integer) |
| Y MIN | number (integer) |
| Y MAX | number (integer) |
| BY ROWS | none |
| BY COLS | none |
| BINARY | none |
| BCD | none |
| ROW LEFT | none |
| ROW RIGHT | none |
| COL UP | none |
| COL DOWN | none |
| FORMAT | character string |
| TITLE | character string |
| M TITLE | character string |
| X OBS | number (integer) |
| Y OBS | number (integer) |
| OBS | pair of numbers (integers) |
| Z SCALE | number |
| RADIUS | number |
| N SECT | none |
| SECTOR | pair of numbers (integers) |
| Z ANGLE | number |
| Z BIAS | number |
| FILE | character string |
| X END | number (integer) |
| Y END | number (integer) |
| END | pair of numbers (integers) |
| NO D W T P | none |
| T POINT | pair of numbers |
| A W ON | none |
| A W OFF | none |
| D W ON | none |
| D W OFF | none |
| READ | none |
| CLASS | pair of numbers |
| N CLASS | number |
| X SLOPE | none |
| SLOPE | none |
| U SLOPE | none |
| U X SLOPE | none |
| ASPECT | none |
| U ASPECT | none |
| U ELEV | none |
| VIEW | none |
| MAP | none |
| AVG MAP | none |
| NUM MAP | none |
| CLEAR | none |
| TABLE | none |
| G MAP | none |
| D CHECK | number |
| D PRINT | none |
| PROFILE | none |
| C ASPECT | none |
| R ASPECT | number |
| COMMENT | character string |

## 4. DEMAND TERMINAL USE

The VIEWIT system may be used in either batch or demand computing. Output on line printers may be requested from small demand terminals.

In a batch run, the system echoes each input card as it is read in, and then prints each command as it is carried out. If the user violates the rules of the command language, there are a number of error messages which are reasonably self-explanatory. An error message will be printed, along with the card containing the offending command, with an '@' printed in the vicinity of the error. In case of an error, the system stops execution. Execution also stops when there are no more commands.

In a demand run, the echoing of input is suppressed. Only the actual result of command execution is printed. Also, if VIEWIT is being run in a demand mode, when an error occurs the system asks the user to re-enter the command or commands, rather than stopping execution as it does in batch mode.

Because VIEWIT uses a relatively large amount of memory and other computer resources while handling a massive problem, it should be used on a demand terminal with a certain amount of caution. Grey-scale maps and other large overlay maps take a large amount of time to type out on a small demand terminal. However, many offices do not have easy access to any other kind of terminal. Therefore, certain features of VIEWIT have been designed for demand use. These features allow the user to do analyses and print out tables and small maps on demand terminals and to divert large maps and other output to high-speed line printers at other locations.

In demand mode, most user input errors are caught by the system, and the user can correct them (in batch mode, the VIEWIT system simply stops when an error is detected). Several additional user commands have been defined for demand users:

| Command | Meaning |
|---|---|
| STOP | Stops execution of the system. |
| DIVERT | Creates a file and causes all printed output from VIEWIT to be sent to the file instead of being printed out at the demand terminal. |
| SEND | Causes the file created by a preceding DIVERT command to be sent to a batch terminal to be printed out on a line printer; the user specifies which batch site by set- |

| | |
|---|---|
| | ting SEND to the site ID (see the example below). |
| MESSAGE | Prints a string of characters in large letter form, with up to 10 lines of 12 characters each. This command is intended for use with DIVERT and SEND to label the batch output. Also, MESSAGE can be used at any time (in either demand or batch mode) to print out large letters for any purpose. |

The DIVERT and SEND commands are especially useful for map output. The following example shows how a user might do a slope class analysis and then print the slope class map at a high-speed site:

SLOPE, TABLE,

(at this point the user inspects the table and decides that the map will be worth printing)

DIVERT, MESSAGE='SEND TO$JONES AT$TAHOE NF', TABLE,MAP,SEND='FCR014',

The 'DIVERT' command creates a file, and puts the words VIEWIT OUTPUT at its beginning in large letters. The 'MESSAGE' command in the example prints in large letters:

SEND TO
JONES AT
TAHOE NF

| Command | Value expected |
|---|---|
| SHOW NZ | none |
| HIDE NZ | none |
| HI ANGLE | number |
| LO ANGLE | number |
| INTERFACE | (optional) character string |
| OVERLAY | (optional) character string |
| RANK | number (integer) |
| MAXIMUM | none |
| AVERAGE | none |
| STATS | none |
| EL STATS | none |
| V STATS | none |

The TABLE and MAP commands print another copy of the slope class table, and a slope class map. Then the SEND command causes the file containing the output produced by all of the above to be printed at batch site FCR014, which happens to be the FCCC site ID for the high-speed terminal in the Forest Service's California Regional Office in San Francisco.

If an error occurs after a 'DIVERT' but before a 'SEND', the error message will go into the file rather than to the terminal. The recommended way to use these two commands is to type in DIVERT, then display commands, then SEND, all on one line. Inspect the line for errors before hitting the carriage return key; if there are errors, cancel the line (control X) and retype it.

If something seems to have happened after a 'DIVERT', output can be returned to the terminal by typing in the transparent control statement:

@@BRKPT PRINT$

The DIVERT command creates a file with a name of the form PRnnnnnnnnnn, where nnnnnnnnnn is a 10-digit number. This is a cataloged public file; normally the SEND command will free it and send it to the specified site with a @SYM operation. If SEND fails, or for whatever reason, the user could explicitly FREE and SYM the file, or delete it, or examine it with the interactive editor.

In other words, the file created by DIVERT is an ordinary Exec-8 file. It can be operated on in any way that any line image file (called 'SDFF' file) can be operated on.

Information developed by the use of VIEWIT analysis options can be saved and later entered into overlay mapping systems to develop combined maps that cannot be produced directly by VIEWIT.

The following commands are used for this capability: XMIN, XMAX, YMIN, YMAX, FORMAT, FILE, BY ROWS, BY COLS, ROW RIGHT, ROW LEFT, COL UP, COL DOWN, BINARY, BCD, OVERLAY, INTERFACE.

The four commands XMIN, XMAX, YMIN, YMAX are used to define a subrectangle within the data, such as for analysis options of VIEWIT. The subrectangle will be written out to a file when the OVERLAY or INTERFACE command is given. (If no subrectangle is specified, the entire data array will be written.) The order in which the data is written is determined by the commands BY ROWS, BY COLS, ROW RIGHT, ROW LEFT, COL UP, COL DOWN, which function in exactly the same way as they do when reading in data with the READ command.

The OVERLAY or INTERFACE command (either word may be used) will cause the contents of the count field of each cell in the current subrectangle to be written out to a file on disk storage. If the file is to contain card or line images, then BCD should be specified. In this case, a format must be supplied by specifying FORMAT. The format that was used to read in the data cannot be further used since the output format must be appropriate to write out integers: that is, it must have 'I' field specifications. The format given should be appropriate to write out one row (or column if BY COLS was specified) of the data.

If BINARY is specified, then the INTERFACE command will cause each row (or column if BY COLS) of the current subrectangle to be written out as one binary record.

The FILE command may be used to specify the file to which overlay information will be written. If the FILE command is not given, the default file name of 'OVERLAY.' will be used for output data. If an overlay is written without changing the file name, the information will follow previous data written to the same file (if any). If the file name is changed, the next INTERFACE command will write into the beginning of the new file. That is, if the user writes an overlay into file A, then another into file B, and then returns to file A for the third overlay, the information from the first overlay will be lost.

The INTERFACE command has two forms. The first is simply:

```
INTERFACE,
```

This form causes the contents of the count field of each cell in the current subrectangle to be written out to the specified or default file. The order and mode of writing are determined by the commands previously mentioned.

The second, optional form of the command provides a label for the overlay data:

```
INTERFACE='INFORMATION TO LABEL THE FILE'.
```

If the overlay is BCD, then the contents of the string of characters between quotes following the INTERFACE command are written to the overlay file as a card image (80 characters), followed by the data from the current subrectangle. If BINARY was specified, then the characters are written to the file as one 20-word binary record (120 characters), followed by the binary data records.

If the file specified by the FILE command (or the default file) exists as a cataloged or temporary file, that file will be used. Otherwise, a temporary file will be created when the INTERFACE command is given.

The following example illustrates the use of the INTERFACE command:

Assume the user has read in data using these commands:

```
NROWS = 200, N COLS=100, ZSCALE=100 ,
FORMAT='(25F3.1)', READ.
```

This will read by rows, bottommost row first, from left to right (all defaults) with four cards per row. The data will come from file 'ZDATA.' (also a default).

The user then defines a subrectangle and calculates slope class values:

```
XMIN = 51, Y MAX = 50, SLOPE, TABLE, MAP.
```

If after seeing the table and map, the user decides to save this slope class data for further analysis or combination with another system, he would do so by

```
FILE = 'SLOPE.', FORMAT = '(50I2)'.
COL DOWN, INTERFACE = 'SLOPE CLASS DATA,
   50 X 50'.
```

After these commands are executed, file 'SLOPE' contains one card image with the label information given between quotes, followed by 50 images--each with one row's slope class numbers. The topmost row appears first because of the COL DOWN command. The other options remain at their default values.

After stopping the VIEWIT operator, the user can call into execution any other program or system, which can read the data from file 'SLOPE.'

Another feature added to VIEWIT for demand use makes it possible for the user to interrupt an operation in progress. This is particularly useful if the user begins to print a long table or map and then decides that he does not want to see it. This is done as follows: First, hold down the 'BREAK' key on the terminal for a moment. This will stop printing and cause the Exec-8 system to print out a message: '*OUTPUT INTERRUPT*'. At this point the user should type in '@@X C' followed by a carriage return. This will generate an interrupt which will cause the VIEWIT system to stop execution of the command in progress and ask the user to submit a new command. (Several lines of the map or table being printed may appear before the interrupt takes effect.)

The Exec-8 rules for the automatic assignment of files are different for demand and batch. Therefore, the demand user should explicitly assign the two files needed to operate VIEWIT. The recommended control card sequence to use is:

```
@ASG,A PSW*VIEWIT.
@ASG,A PSW*LOG.
@FREE PSW*LOG.
@XQT PSW*VIEWIT.
```

(Either '@ASG' statement may result in the message 'WAITING FOR FACILITY'. In this case the demand user must wait until the Exec-8 system makes the file available. This will normally take only a few minutes.)

# ASPECT

# MAP

| | | | | | 5 | | | | | 10 | | | | | 15 | | | | | 20 | | | | | 25 | | | | | 30 | | | | | 35 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | 1 | 1 | 1 | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 7 | 6 | | 7 | 7 | 7 | 8 |
| 51 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | | | | | | | | | | | | | | 6 | 8 | 1 | 1 | 2 | 2 | | | 7 | 7 | 7 | | 7 | 7 | 8 | 8 |
| 50 | | | 3 | 3 | 8 | 1 | 2 | 2 | | | | | | | | | | | | 8 | 6 | 1 | 1 | 1 | 2 | 2 | | | 8 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| 49 | 5 | 5 | 4 | 5 | 8 | 2 | 3 | 2 | | | | | | | | | | | | 8 | 8 | 8 | 2 | 2 | 3 | 3 | | 6 | 7 | 8 | 8 | 8 | 6 | 8 | 7 | 6 |
| 48 | 5 | 5 | 5 | 6 | 6 | 6 | 4 | 3 | | | | | | | | | | | | 7 | 7 | 7 | 3 | 3 | 3 | 3 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 6 | 6 | 6 |
| 47 | | | 6 | 6 | 5 | 5 | 4 | 4 | | | | | | | | 8 | 8 | 1 | 1 | 5 | 7 | 5 | 4 | 4 | 2 | 2 | 1 | 8 | 6 | 8 | 8 | 1 | 1 | 7 | 8 | 8 |
| 46 | | | | | | 6 | 5 | 4 | | | | | | | | 7 | 8 | 8 | 1 | 1 | 6 | 5 | 5 | 5 | 4 | 4 | 7 | 7 | 7 | 7 | 6 | 5 | 5 | 7 | 8 | 8 |
| 45 | 4 | 1 | 2 | | | | | | | | | | | | | 6 | 7 | 6 | 4 | 4 | 5 | 4 | 5 | 6 | 5 | 5 | 6 | 6 | 5 | 5 | 5 | 5 | 6 | 7 | 7 | 7 |
| 44 | 1 | 1 | 2 | 2 | | | | | | | | | | | | | 6 | 6 | 5 | 4 | 4 | | | | | | 6 | 6 | 5 | 5 | 5 | 7 | 7 | 7 | 6 | 6 |
| 43 | 8 | 1 | 1 | 2 | 2 | | | | | | | | | | | | 6 | 6 | 4 | 4 | | | | | | | 6 | 5 | 4 | | 8 | 8 | 8 | 8 | 6 | 6 |
| 42 | 8 | 8 | 1 | 2 | 2 | 1 | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 8 | 8 | 4 | 4 |
| 41 | 7 | 7 | | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | | 4 | 4 |
| 40 | 7 | 7 | 7 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | | | | | | | 8 | 8 | 1 | 1 | 1 | 1 | 1 | 2 | 7 | 7 | 6 | 5 | 4 | 4 |
| 39 | 8 | 7 | 6 | 1 | 1 | 8 | 2 | 2 | 8 | 8 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 6 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 8 | 7 | 6 | 5 | 4 | 4 |
| 38 | 2 | 7 | 7 | 8 | 8 | 8 | 1 | 2 | 1 | 8 | 8 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 7 | 6 | 5 | 6 | |
| 37 | 4 | 5 | 7 | 7 | 8 | 8 | 1 | 2 | 1 | 8 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 6 | 5 | 5 | 6 | 6 |
| 36 | 4 | 5 | 6 | 6 | 7 | 6 | 4 | 3 | 1 | 8 | 6 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 7 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 5 | 6 | 7 | 8 |
| 35 | 4 | 5 | 7 | 7 | 7 | 6 | 6 | 2 | 1 | 8 | 8 | 1 | 1 | 1 | 1 | 8 | 2 | 1 | 8 | 1 | 8 | 8 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 3 | 2 | 2 | 2 | 8 | 7 | 8 |
| 34 | 5 | 6 | 7 | 8 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 6 | 7 | 7 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 7 | 7 | 7 |
| 33 | 5 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 1 | 2 | 2 | 1 | 8 | 1 | 2 | 2 | 2 | 6 | 7 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 6 | 7 | 6 |
| 32 | 8 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 3 | 3 | 8 | 8 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 7 | 6 | 5 |
| 31 | 8 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 3 | 2 | 8 | 8 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 7 | 6 |
| 30 | 6 | 7 | 7 | 6 | 6 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 4 | 5 | 7 | 8 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 3 | 2 | 8 | 2 | 2 | |
| 29 | 6 | 6 | 6 | 8 | 6 | 6 | 7 | 7 | 7 | 8 | 7 | 6 | 4 | 6 | 7 | 7 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 6 | 8 | 3 | 2 | |
| 28 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 7 | 6 | 5 | 4 | 6 | 7 | 7 | 8 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 5 | 6 | 3 | 2 | 6 |
| 27 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 5 | 5 | 5 | 5 | 6 | 7 | 6 | 7 | 8 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 8 | 7 | 2 | 2 | 1 |
| 26 | 8 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 6 | 5 | 4 | 5 | 6 | 6 | 7 | 7 | 7 | 8 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 2 | 1 | 8 | 2 | 1 | 6 |
| 25 | 9 | 8 | 8 | 7 | 7 | 6 | 7 | 7 | 6 | 4 | 5 | 6 | 7 | 8 | 8 | 7 | 7 | 7 | 3 | 3 | 4 | 4 | 3 | 4 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 7 | 7 | 3 | 3 | 7 |
| 24 | 7 | 7 | 8 | 7 | 7 | 7 | 7 | 7 | 5 | 4 | 6 | 8 | 8 | 8 | 8 | 8 | 7 | 6 | 5 | 4 | 4 | 3 | 3 | 4 | 5 | 4 | 4 | | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 |
| 23 | 6 | 7 | 6 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 7 | 8 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 8 | 1 | 2 | 1 | 8 | 1 | 2 | 2 | 1 |
| 22 | 7 | 7 | 7 | 6 | 7 | 6 | 6 | 5 | 5 | 7 | 7 | 7 | 7 | 6 | 5 | 5 | 6 | 6 | 6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 8 | 8 | 2 | | 8 | 2 | 2 | 2 | 2 |
| 21 | 7 | 7 | 6 | 6 | 8 | 6 | 6 | 6 | 7 | 8 | 7 | 7 | 6 | 5 | 5 | 6 | 7 | 7 | 7 | | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 8 | 1 | 2 | 1 | 8 | 1 | 2 | 2 | 1 |
| 20 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 7 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 6 | 6 | 6 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| 19 | 6 | 6 | 7 | 6 | 5 | 6 | 7 | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 7 | 7 | 5 | 6 | 6 | 6 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 8 | 2 | 2 | 1 |
| 18 | 7 | 7 | 7 | 7 | | 7 | 6 | 5 | 6 | 7 | 8 | 7 | 6 | 6 | 6 | 6 | 5 | 6 | 6 | 6 | 4 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | | | 3 | | 8 | 2 | 2 | 2 |
| 17 | 7 | 8 | 8 | 1 | 1 | 8 | 7 | 7 | 7 | 8 | 8 | 8 | 7 | 6 | 6 | 6 | 6 | 7 | 7 | 6 | 4 | 3 | 3 | 2 | 1 | 8 | 2 | 3 | | | 3 | | 7 | 4 | 3 | 4 |
| 16 | 8 | 8 | 8 | 8 | 1 | 2 | 8 | 8 | 7 | 7 | 8 | 1 | 1 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 4 | 4 | 3 | 3 | | | 3 | 3 | | 4 | 3 | 6 | 7 | 4 | 3 | 4 |
| 15 | 8 | 8 | 8 | 8 | 2 | 2 | 8 | 8 | 7 | 7 | 7 | 7 | 8 | 1 | 1 | 8 | 8 | 8 | 7 | 8 | 2 | 3 | 3 | 3 | | 4 | 3 | 4 | 4 | 4 | 4 | 6 | 7 | 2 | 2 | 1 |
| 14 | 1 | 1 | 1 | 8 | 2 | 2 | 1 | 8 | 8 | 8 | 8 | 7 | 7 | 8 | 1 | 1 | 6 | 8 | 8 | 8 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 6 | 7 | | 2 | 1 |
| 13 | 1 | 1 | 8 | 1 | 2 | 1 | 1 | 1 | 7 | 8 | 1 | 8 | 8 | 7 | 8 | 8 | 6 | 8 | 6 | 8 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | | 6 | 6 | 6 | 5 | 4 |
| 12 | 1 | 1 | 8 | 1 | 2 | 1 | 1 | 2 | 7 | 7 | 8 | 1 | 8 | 8 | 8 | 8 | 1 | 8 | 8 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 6 | 6 | 5 | 5 |
| 11 | 5 | 8 | 8 | 1 | 1 | 1 | 1 | 2 | 7 | 7 | 7 | 8 | 1 | 1 | 8 | 8 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 2 | 2 | 2 | 3 | | 6 | 5 | 4 |
| 10 | 5 | 6 | 7 | 8 | 1 | 1 | 1 | 2 | 8 | 7 | 7 | 8 | 8 | 1 | 1 | 8 | 8 | 4 | 5 | 1 | 2 | 2 | 2 | | 3 | 3 | 3 | | 3 | 4 | 4 | 4 | | | | |
| 9 | 8 | 6 | 6 | 7 | 8 | 1 | 2 | 2 | 1 | 8 | 7 | 8 | 8 | 1 | 1 | 6 | 5 | 4 | 5 | 6 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 5 | 4 | 4 | | | | | |
| 8 | 6 | 7 | 7 | 7 | 8 | 1 | 1 | 1 | 1 | 8 | 8 | 8 | 8 | 8 | 6 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 4 | 4 | | | | | | |
| 7 | 7 | 7 | 8 | 7 | 8 | 8 | 2 | 1 | 1 | 1 | 8 | 7 | 7 | 4 | 3 | 4 | 5 | 5 | 5 | 6 | 6 | 7 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 4 | 4 | 5 | 5 | 5 | 6 | 6 |
| 6 | 8 | 7 | 7 | 7 | 7 | 7 | 3 | 3 | 4 | 5 | 6 | 6 | 6 | 4 | 4 | 3 | 4 | 4 | 5 | 6 | 6 | 6 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 5 |
| 5 | 7 | 7 | 7 | 7 | 7 | 6 | 4 | 5 | 5 | 4 | 6 | 6 | 6 | 5 | 4 | 3 | 3 | 4 | 5 | 6 | 6 | 6 | 5 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | | | 8 | 6 | 1 |
| 4 | 8 | 7 | 7 | 7 | 7 | 5 | 4 | 4 | 5 | 5 | 6 | 6 | 5 | 6 | 6 | 3 | 3 | 3 | 5 | 5 | 6 | 6 | 5 | 4 | 4 | 4 | 4 | 3 | 2 | 3 | 3 | | | 7 | 8 | 2 |
| 3 | 8 | 7 | 7 | 7 | 7 | 4 | 4 | 4 | 5 | 6 | 6 | 7 | 4 | 6 | 6 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 6 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 8 | 2 | 8 | 7 | |
| 2 | 8 | 8 | 8 | 7 | 7 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 4 | 6 | 6 | 4 | 3 | 3 | 4 | 4 | 6 | 7 | 6 | 3 | 3 | 3 | 4 | 5 | 4 | 3 | 8 | 1 | 1 | 1 | 8 | |
| 1 | 7 | 7 | 7 | 7 | 7 | 4 | 4 | 4 | 4 | 7 | 7 | 6 | 4 | 5 | 7 | 4 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 3 | 3 | 3 | 3 | 5 | 4 | 4 | 7 | 8 | 2 | 2 | 8 | |
| | | | | | 5 | | | | | 10 | | | | | 15 | | | | | 20 | | | | | 25 | | | | | 30 | | | | | 35 | |

USER REQUEST: GMAP

# ASPECT MAP

```
   USER REQUEST: COMMEN =
AND RELATIVE ASPECT
   USER REQUEST: RASPEC =      180

ASPECT CLASSES CALCULATED RELATIVE TO THE USER-SPECIFIED DIRECTION OF 180,0 DEGREES


   USER REQUEST: TABLE


TABLE OF ASPECTS RELATIVE TO USER-SPECIFIED DIRECTION
     THERE ARE 8 CLASSES, EACH REPRESENTING ANGLES IN TWO 22,5
     DEGREE BANDS, ONE ON EACH SIDE OF THE SPECIFIED DIRECTION:
        1          +-0,     TO 22,5   DEG, RELATIVE TO THE GIVEN ANGLE
        2          +-22,5   TO 45     DEG
        3          +-45     TO 67,5   DEG
        4          +-67,5   TO 90,    DEG
        5          +-90,    TO 112,5  DEG
        6          +-112,5  TO 135,   DEG
        7          +-135,   TO 157,5  DEG
        8          +-157,5  TO 180,   DEG
        ZERO       NO ASPECT (FLAT)
```

| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 237 | 1,13 | 725,44 | 1792,58 |
| 1 | 114 | ,55 | 348,94 | 862,26 |
| 2 | 202 | ,97 | 618,30 | 1527,86 |
| 3 | 169 | ,81 | 517,29 | 1278,26 |
| 4 | 147 | ,70 | 449,95 | 1111,86 |
| 5 | 309 | 1,48 | 945,82 | 2337,17 |
| 6 | 186 | ,89 | 569,33 | 1406,84 |
| 7 | 274 | 1,31 | 838,69 | 2072,44 |
| 8 | 234 | 1,12 | 716,25 | 1769,89 |

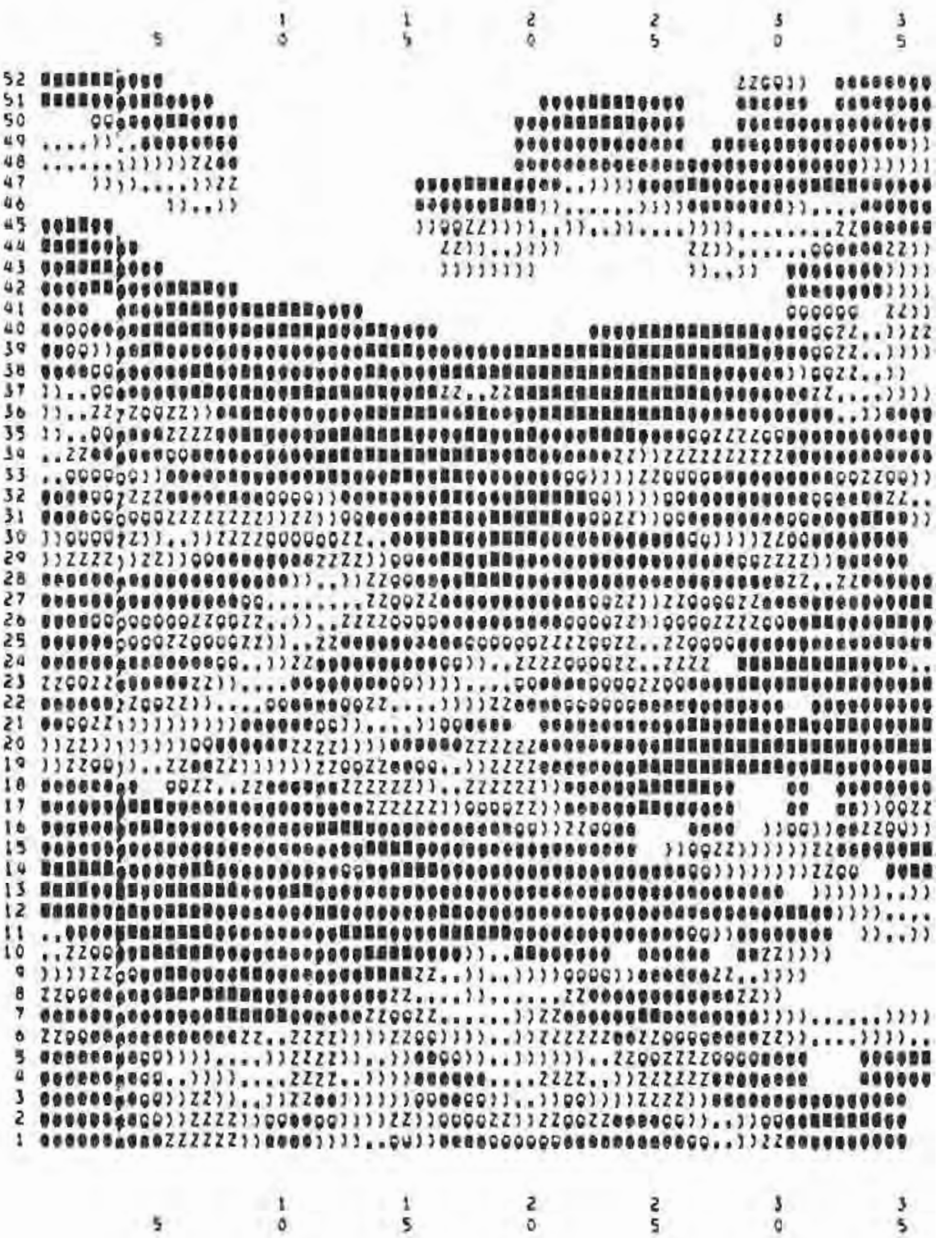
```
   USER REQUEST: MAP


MAP OF CELL ASPECT RELATIVE TO A USER-SPECIFIED DIRECTION,
     THERE ARE 8 CLASSES, EACH REPRESENTING ANGLES IN TWO 22,5
     DEGREE BANDS, ONE ON EACH SIDE OF THE SPECIFIED DIRECTION:
        1          +-0,     TO 22,5   DEG, RELATIVE TO THE GIVEN ANGLE
        2          +-22,5   TO 45     DEG
        3          +-45     TO 67,5   DEG
        4          +-67,5   TO 90,    DEG
        5          +-90,    TO 112,5  DEG
        6          +-112,5  TO 135,   DEG
        7          +-135,   TO 157,5  DEG
        8          +-157,5  TO 180,   DEG
        BLANK      NO ASPECT (FLAT)
(IF THE GIVEN ANGLE IS THE SUN DIRECTION, THIS IS
AN APPROXIMATE SUN-ILLUMINATION MAP.)
```

# ASPECT MAP

| | | | | | 5 | | | | | 10 | | | | | 15 | | | | | 20 | | | | | 25 | | | | | 30 | | | | | 35 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | 8 | 8 | 8 | 7 | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 | 4 | 2 |  | 5 | 5 | 5 | 6 |
| 51 | 8 | 8 | 7 | 7 | 8 | 7 | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  | 7 | 7 | 8 | 8 | 7 | 7 |  |  | 5 | 5 | 5 |  | 5 | 5 | 6 | 7 |
| 50 |  |  | 4 | 5 | 7 | 8 | 7 | 7 |  |  |  |  |  |  |  |  |  |  |  | 7 | 7 | 8 | 8 | 8 | 7 | 6 |  |  | 6 | 5 | 7 | 7 | 6 | 6 | 6 | 7 |
| 49 | 1 | 1 | 2 | 1 | 6 | 7 | 5 | 6 |  |  |  |  |  |  |  |  |  |  |  | 6 | 6 | 7 | 7 | 6 | 5 | 5 |  | 7 | 5 | 6 | 7 | 7 | 6 | 6 | 5 | 2 |
| 48 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 |  |  |  |  |  |  |  |  |  |  |  | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 2 | 2 |
| 47 |  |  | 2 | 2 | 1 | 1 | 2 | 3 |  |  |  |  |  |  |  | 7 | 7 | 8 | 8 | 7 | 5 | 1 | 2 | 2 | 6 | 7 | 8 | 7 | 7 | 7 | 7 | 8 | 8 | 5 | 6 | 7 |
| 46 |  |  |  |  |  | 2 | 1 | 2 |  |  |  |  |  |  |  | 5 | 6 | 7 | 8 | 8 | 2 | 1 | 1 | 1 | 2 | 2 | 5 | 5 | 5 | 5 | 2 | 1 | 1 | 5 | 7 | 7 |
| 45 | 7 | 8 | 7 |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 4 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 5 | 5 | 5 |
| 44 | 6 | 8 | 7 | 7 |  |  |  |  |  |  |  |  |  |  |  |  | 3 | 2 | 1 | 2 | 2 |  |  |  |  |  | 3 | 2 | 1 | 1 | 1 | 4 | 5 | 5 | 3 | 2 |
| 43 | 7 | 8 | 8 | 7 | 7 |  |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 2 | 2 |  |  |  |  |  |  | 2 | 1 | 2 |  | 6 | 6 | 6 | 6 | 2 | 2 |
| 42 | 6 | 6 | 8 | 7 | 6 | 8 | 8 | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 5 | 5 | 6 | 7 | 2 | 2 |
| 41 | 5 | 5 |  | 5 | 6 | 8 | 8 | 7 | 8 | 8 | 8 | 7 | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 | 4 | 4 |  | 3 | 2 |
| 40 | 5 | 4 | 5 | 5 | 8 | 8 | 8 | 7 | 8 | 8 | 8 | 8 | 7 | 8 | 7 | 7 |  |  |  |  |  |  | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 7 | 5 | 4 | 3 | 1 | 2 | 3 |
| 39 | 7 | 4 | 2 | 5 | 8 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 4 | 3 | 1 | 2 | 2 |
| 38 | 7 | 5 | 4 | 7 | 7 | 7 | 8 | 7 | 8 | 6 | 7 | 7 | 7 | 8 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 6 | 8 | 8 | 8 | 8 | 7 | 6 | 5 | 2 | 4 | 3 | 1 | 2 |  |
| 37 | 2 | 1 | 4 | 5 | 6 | 7 | 8 | 7 | 8 | 7 | 8 | 8 | 8 | 8 | 7 | 8 | 3 | 1 | 3 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 6 | 6 | 6 | 5 | 3 | 1 | 1 | 2 | 2 |
| 36 | 2 | 1 | 3 | 3 | 4 | 3 | 2 | 5 | 8 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 5 | 8 | 5 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 6 | 5 | 5 | 6 | 7 | 7 | 1 | 2 | 5 | 7 |
| 35 | 2 | 1 | 4 | 5 | 5 | 3 | 3 | 7 | 8 | 7 | 7 | 8 | 8 | 8 | 8 | 7 | 7 | 8 | 7 | 8 | 7 | 7 | 8 | 8 | 7 | 5 | 4 | 3 | 3 | 4 | 6 | 7 | 7 | 6 | 5 | 7 |
| 34 | 1 | 3 | 5 | 6 | 5 | 4 | 5 | 7 | 7 | 6 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 8 | 6 | 5 | 5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 7 | 6 | 6 | 5 | 5 | 5 |
| 33 | 1 | 4 | 4 | 4 | 2 | 5 | 5 | 5 | 6 | 7 | 7 | 8 | 7 | 6 | 8 | 7 | 8 | 7 | 6 | 7 | 6 | 4 | 2 | 2 | 3 | 4 | 4 | 5 | 7 | 7 | 7 | 5 | 4 | 3 | 4 | 2 |
| 32 | 6 | 5 | 4 | 3 | 3 | 5 | 5 | 5 | 5 | 4 | 4 | 2 | 5 | 5 | 7 | 6 | 8 | 6 | 7 | 8 | 8 | 8 | 4 | 2 | 2 | 4 | 6 | 7 | 7 | 7 | 5 | 4 | 5 | 5 | 3 | 1 |
| 31 | 7 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 4 | 6 | 7 | 7 | 8 | 6 | 8 | 8 | 8 | 6 | 4 | 3 | 2 | 4 | 5 | 6 | 6 | 5 | 4 | 5 | 7 | 8 | 5 | 2 |
| 30 | 2 | 4 | 4 | 3 | 2 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 1 | 5 | 6 | 8 | 6 | 8 | 8 | 6 | 5 | 5 | 7 | 7 | 6 | 4 | 2 | 2 | 3 | 4 | 7 | 7 | 7 | 7 |  |
| 29 | 2 | 3 | 3 | 2 | 3 | 2 | 4 | 5 | 5 | 6 | 5 | 3 | 3 | 2 | 4 | 5 | 8 | 7 | 8 | 7 | 5 | 6 | 7 | 7 | 7 | 6 | 6 | 5 | 4 | 3 | 3 | 2 | 6 | 5 | 6 |  |
| 28 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 5 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 8 | 6 | 6 | 7 | 6 | 5 | 5 | 5 | 6 | 6 | 6 | 5 | 3 | 1 | 3 | 5 | 6 | 7 |
| 27 | 5 | 5 | 6 | 7 | 6 | 6 | 6 | 5 | 4 | 1 | 1 | 1 | 1 | 3 | 4 | 3 | 5 | 7 | 7 | 6 | 6 | 5 | 4 | 3 | 2 | 3 | 4 | 4 | 3 | 5 | 5 | 7 | 5 | 6 | 7 | 8 |
| 26 | 6 | 5 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 1 | 2 | 1 | 3 | 3 | 4 | 4 | 5 | 6 | 6 | 6 | 5 | 4 | 4 | 3 | 2 | 4 | 4 | 3 | 3 | 4 | 7 | 8 | 7 | 6 | 8 | 7 |
| 25 | 7 | 6 | 6 | 4 | 4 | 3 | 4 | 4 | 3 | 2 | 1 | 3 | 5 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 1 | 3 | 4 | 4 | 7 | 7 | 7 | 5 | 5 | 5 | 5 | 5 |
| 24 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 4 | 1 | 2 | 3 | 6 | 7 | 7 | 6 | 6 | 4 | 2 | 1 | 3 | 3 | 4 | 4 | 3 | 1 | 3 | 3 |  | 8 | 8 | 8 | 8 | 8 | 6 | 5 | 1 |
| 23 | 3 | 4 | 3 | 6 | 5 | 5 | 3 | 2 | 1 | 1 | 5 | 6 | 6 | 5 | 4 | 2 | 2 | 1 | 1 | 4 | 5 | 5 | 4 | 4 | 3 | 4 | 5 | 7 | 8 | 7 | 8 | 7 | 8 | 7 | 7 | 8 |
| 22 | 5 | 5 | 5 | 3 | 4 | 3 | 2 | 1 | 1 | 4 | 5 | 5 | 4 | 3 | 1 | 1 | 2 | 2 | 3 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 7 | 7 | 7 | 6 |  | 6 | 7 | 6 | 6 | 7 |
| 21 | 5 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 5 | 6 | 5 | 4 | 2 | 1 | 1 | 2 | 4 | 5 | 5 |  | 5 | 5 | 5 | 5 | 5 | 6 | 8 | 7 | 8 | 7 | 8 | 7 | 8 | 6 | 7 | 8 |
| 20 | 2 | 3 | 2 | 2 | 2 | 2 | 4 | 6 | 6 | 5 | 3 | 3 | 2 | 2 | 5 | 5 | 5 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 6 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 8 | 8 |
| 19 | 2 | 3 | 4 | 2 | 1 | 3 | 5 | 3 | 2 | 2 | 2 | 3 | 4 | 3 | 5 | 4 | 1 | 2 | 3 | 3 | 5 | 5 | 5 | 6 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 8 | 7 | 7 | 7 | 8 |
| 18 | 5 | 5 | 5 | 5 |  | 4 | 3 | 1 | 3 | 5 | 7 | 5 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 5 | 5 | 7 | 8 | 8 | 8 | 6 |  |  | 5 |  | 6 | 7 | 7 | 6 |
| 17 | 5 | 6 | 7 | 8 | 8 | 7 | 5 | 5 | 5 | 6 | 7 | 7 | 5 | 3 | 3 | 3 | 2 | 4 | 4 | 3 | 2 | 5 | 5 | 7 | 8 | 7 | 6 | 5 |  |  | 5 |  | 5 | 2 | 4 | 3 |
| 16 | 7 | 7 | 7 | 7 | 8 | 7 | 6 | 6 | 5 | 5 | 6 | 8 | 8 | 7 | 7 | 5 | 5 | 5 | 5 | 4 | 2 | 3 | 4 | 5 |  |  | 5 | 5 |  | 2 | 4 | 2 | 5 | 3 | 4 | 2 |
| 15 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 6 | 5 | 5 | 5 | 5 | 7 | 8 | 8 | 7 | 7 | 7 | 5 | 6 | 7 | 5 | 5 | 5 |  | 2 | 4 | 3 | 2 | 2 | 2 | 3 | 5 | 6 | 7 | 8 |
| 14 | 6 | 6 | 8 | 7 | 6 | 7 | 8 | 6 | 6 | 6 | 6 | 5 | 4 | 7 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 5 | 4 | 2 | 2 | 2 | 2 | 3 | 4 |  | 7 | 8 |
| 13 | 8 | 8 | 7 | 8 | 6 | 8 | 8 | 8 | 5 | 6 | 8 | 7 | 6 | 5 | 7 | 7 | 7 | 7 | 6 | 7 | 5 | 5 | 6 | 7 | 7 | 6 | 5 | 6 | 5 | 5 |  | 2 | 2 | 2 | 1 | 2 |
| 12 | 8 | 8 | 7 | 8 | 7 | 8 | 8 | 7 | 5 | 5 | 6 | 8 | 7 | 7 | 6 | 7 | 8 | 7 | 7 | 7 | 5 | 5 | 6 | 7 | 6 | 5 | 5 | 6 | 5 | 7 | 8 | 7 | 2 | 2 | 1 | 1 |
| 11 | 1 | 6 | 7 | 8 | 8 | 8 | 8 | 6 | 5 | 5 | 5 | 7 | 8 | 8 | 6 | 7 | 8 | 8 | 8 | 7 | 6 | 6 | 7 | 7 | 6 | 5 | 4 | 2 | 6 | 6 | 7 | 5 |  | 2 | 1 | 2 |
| 10 | 1 | 3 | 4 | 7 | 8 | 8 | 8 | 7 | 7 | 5 | 5 | 6 | 7 | 8 | 6 | 7 | 7 | 2 | 1 | 8 | 7 | 6 | 6 |  | 5 | 5 | 5 |  | 5 | 3 | 2 | 2 |  |  |  |  |
| 9 | 2 | 2 | 3 | 4 | 7 | 8 | 7 | 7 | 8 | 6 | 5 | 6 | 7 | 8 | 8 | 3 | 1 | 2 | 1 | 2 | 2 | 4 | 4 | 2 | 5 | 5 | 5 | 3 | 1 | 2 | 2 |  |  |  |  |  |
| 8 | 3 | 4 | 5 | 5 | 6 | 8 | 6 | 8 | 8 | 7 | 6 | 6 | 6 | 7 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 5 | 6 | 7 | 6 | 6 | 5 | 3 | 2 |  |  |  |  |  |  |
| 7 | 5 | 5 | 6 | 5 | 6 | 7 | 7 | 8 | 8 | 8 | 6 | 5 | 5 | 3 | 4 | 3 | 1 | 1 | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 5 | 5 | 6 | 6 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| 6 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 1 | 3 | 3 | 2 | 2 | 3 | 4 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 5 | 3 | 4 | 4 | 5 | 5 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| 5 | 5 | 5 | 5 | 5 | 4 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 5 | 4 | 2 | 1 | 2 | 2 | 2 | 1 | 3 | 4 | 3 | 3 | 4 | 4 | 5 | 5 |  |  | 6 | 6 | 8 |
| 4 | 6 | 5 | 5 | 5 | 4 | 1 | 2 | 2 | 1 | 1 | 3 | 3 | 1 | 2 | 2 | 5 | 5 | 5 | 1 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 5 | 6 | 5 | 5 |  |  | 5 | 6 | 7 |
| 3 | 6 | 5 | 5 | 5 | 4 | 2 | 3 | 2 | 1 | 2 | 3 | 5 | 2 | 2 | 2 | 4 | 5 | 4 | 2 | 1 | 2 | 4 | 2 | 2 | 3 | 3 | 2 | 5 | 5 | 5 | 6 | 7 | 7 | 6 | 5 |  |
| 2 | 6 | 6 | 6 | 5 | 4 | 2 | 3 | 3 | 2 | 4 | 5 | 4 | 2 | 2 | 3 | 2 | 4 | 4 | 3 | 2 | 3 | 4 | 3 | 5 | 5 | 4 | 2 | 1 | 2 | 4 | 7 | 8 | 8 | 8 | 6 |  |
| 1 | 5 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 2 | 5 | 5 | 2 | 2 | 1 | 4 | 2 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 1 | 2 | 3 | 5 | 7 | 7 | 7 | 7 |  |
| |  |  |  |  | 5 |  |  |  |  | 10 |  |  |  |  | 15 |  |  |  |  | 20 |  |  |  |  | 25 |  |  |  |  | 30 |  |  |  |  | 35 |  |

USER REQUEST: GMAP

# ASPECT MAP



```
** INPUT CARD:  COMMENT='CHECK CELLS WHICH DIFFER FROM THE AVERAGE OF THEIR NEIGHBORS BY MORE TH

** INPUT CARD:  AN 150 FEET.', MTITLE='DATA CHECK$MAP', D CHECK=150. , MAP, GMAP, TABLE.

   USER REQUEST: COMMEN =
CHECK CELLS WHICH DIFFER FROM THE AVERAGE OF THEIR NEIGHBORS BY MORE THAN 150 FEET.
   USER REQUEST: MTITLE =
DATA CHECK  MAP
MAP TITLE IS: DATA CHECK
              MAP
   USER REQUEST: DCHECK =      150

DATA CHECK COMPLETED.  OF   1872 CELLS,     25 DIFFER FROM THE AVERAGE OF THEIR NEIGHBORS

   BY MORE THAN    150.0 FEET.

   USER REQUEST: MAP


DATA CHECK CLASS MAP.
      BLANK CELLS PASS THE TEST.
      1 MEANS CELLS DIFFER FROM THE AVERAGE OF THEIR NEIGHBORS
      BY AN AMOUNT BETWEEN THE SPECIFIED TOLERANCE AND TWICE
      THE TOLERANCE.
      2 MEANS THE DIFFERENCE IS 2*TOLERANCE TO 3*TOLERANCE, ETC.
```

# DATA CHECK MAP

```
                      1         1         2         2         3         3
            5         0         5         0         5         0         5

52
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37            1 1         1         2 3 3
36                                  527 2
35                                  3 3 3
34                                              1
33
32
31
30
29
28
27                                                                6 1
26                                                                  1
25                                                    1
24
23
22
21
20
19
18                  1           1
17
16
15
14
13
12
11
10                  1               1
 9
 8      1
 7
 6            1
 5  1
 4
 3
 2                          1
 1

                      1         1         2         2         3         3
            5         0         5         0         5         0         5
```

```
   USER REQUEST: TABLE

DATA CHECK CLASS TABLE.
     0 MEANS CELLS PASS THE TEST.
     1 MEANS CELLS DIFFER FROM THE AVERAGE OF THEIR NEIGHBORS
     BY AN AMOUNT BETWEEN THE SPECIFIED TOLERANCE AND TWICE
     THE TOLERANCE.
     2 MEANS THE DIFFERENCE IS 2*TOLERANCE TO 3*TOLERANCE, ETC.
```

| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 1847 | 8.83 | 5653.50 | 13970.05 |
| 1 | 15 | .07 | 45.91 | 113.45 |
| 2 | 2 | .01 | 6.12 | 15.13 |
| 3 | 5 | .02 | 15.30 | 37.82 |
| 5 | 1 | .00 | 3.06 | 7.56 |
| 6 | 1 | .00 | 3.06 | 7.56 |
| 27 | 1 | .00 | 3.06 | 7.56 |

```
** INPUT CARD:  COMMENT='NOTICE THAT THERE IS ONE ESPECIALLY BAD CELL AT (17,36)'.

   USER REQUEST: COMMEN =
NOTICE THAT THERE IS ONE ESPECIALLY BAD CELL AT (17,36)

** INPUT CARD:  COMMENT='ITS NEIGHBORS APPEAR IN ERROR ALSO BECAUSE THIS ONE CELL ALTERS THE AVE

** INPUT CARD:  RAGE FOR THOSE CELLS.',

   USER REQUEST: COMMEN =
ITS NEIGHBORS APPEAR IN ERROR ALSO BECAUSE THIS ONE CELL ALTERS THE AVERAGE FOR THOSE CELLS.

** INPUT CARD:  COMMENT='PRINT THE ACTUAL ELEVATION DATA',MESSAGE='ELEVATIONSMAP', DPRINT.

   USER REQUEST: COMMEN =
PRINT THE ACTUAL ELEVATION DATA
   USER REQUEST: MESSAG =
ELEVATION    MAP



   USER REQUEST: DPRINT
```

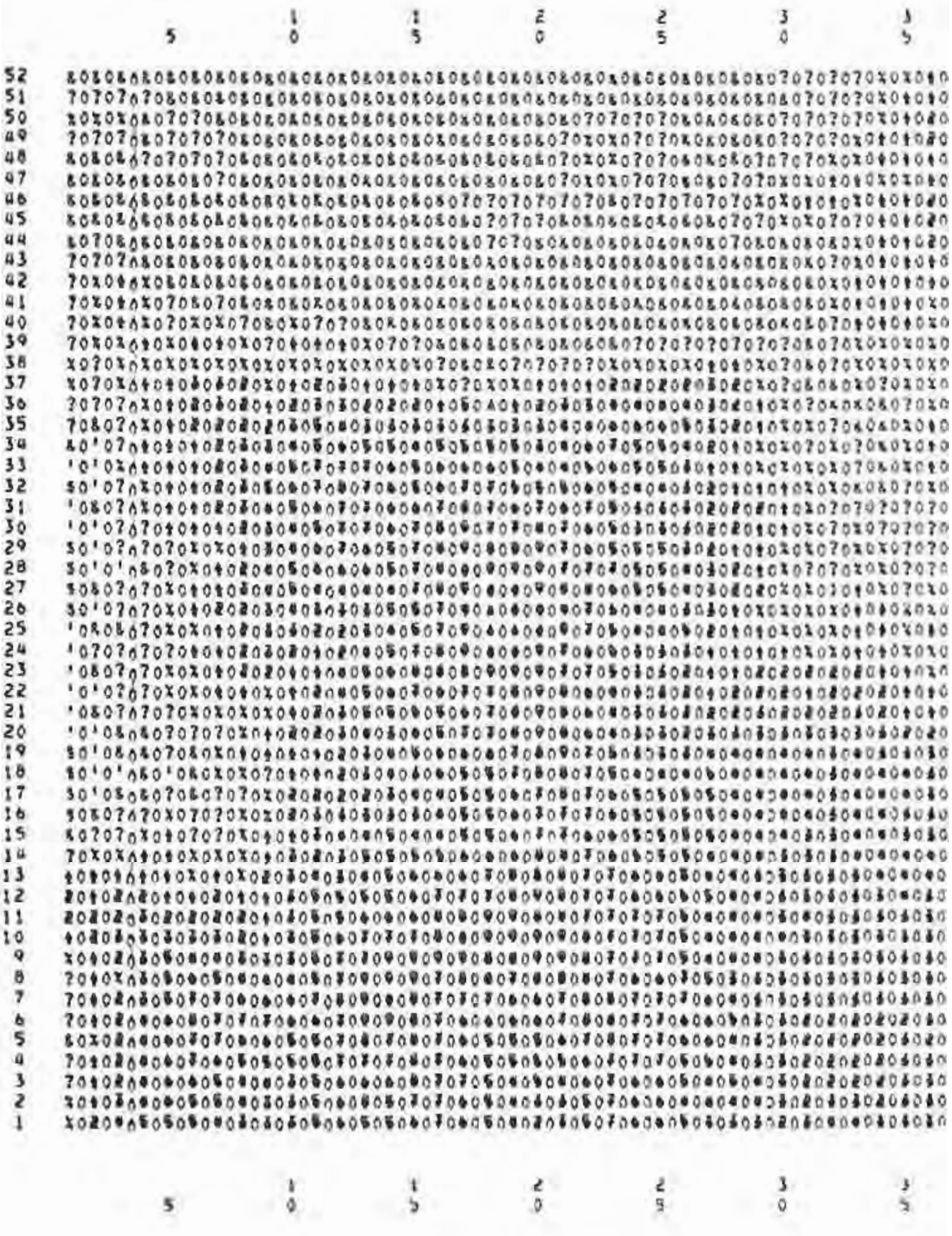
ELEVATION MAP

FIRST SYMBOL GIVES THOUSANDS AND HUNDREDS DIGIT, SECOND NUMBER IS TENS DIGIT.

TABLE OF SYMBOLS

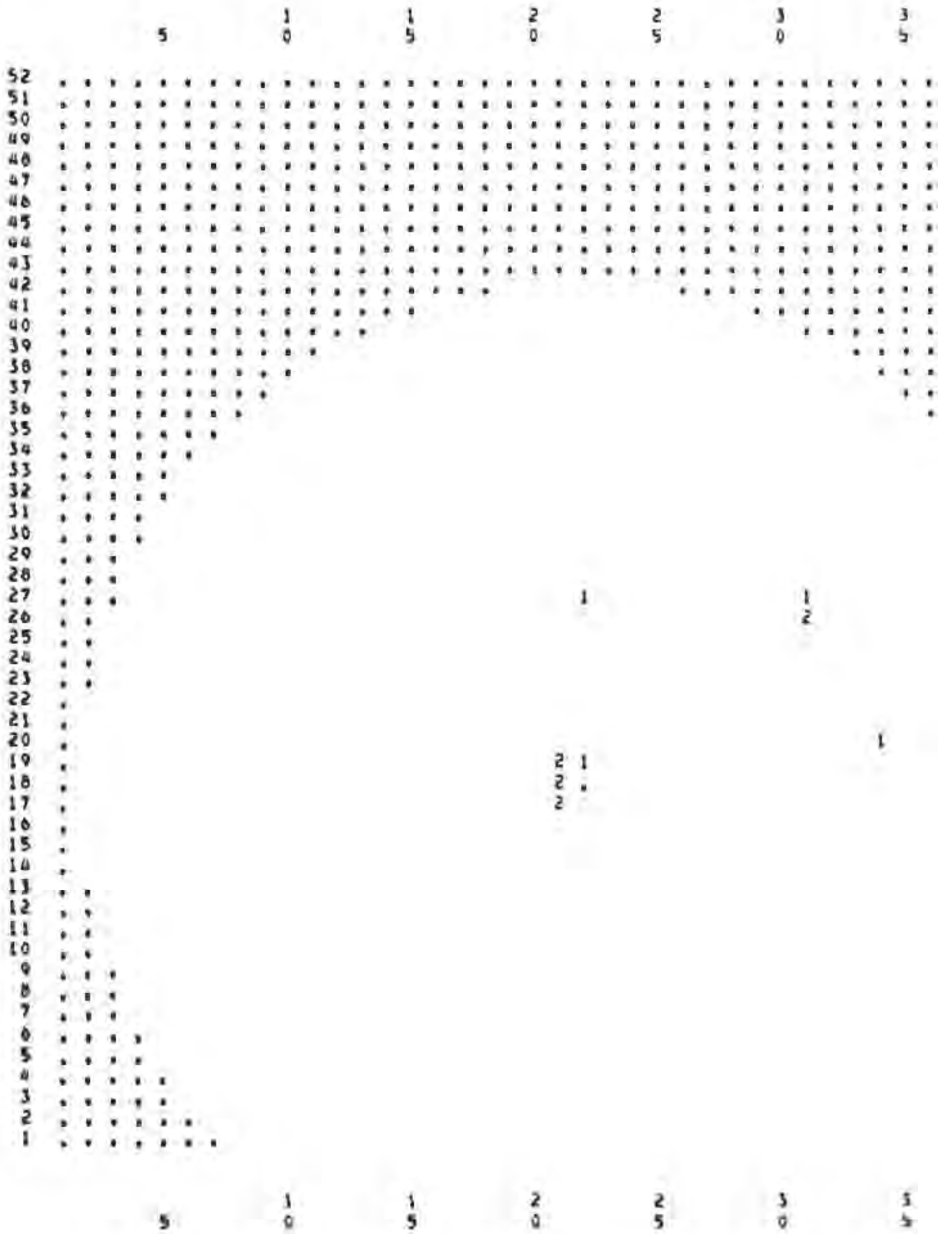
| ELEVATION | SYMBOL | ELEVATION | SYMBOL | ELEVATION | SYMBOL | ELEVATION | SYMBOL |
|---|---|---|---|---|---|---|---|
| 100 | 1 | 5100 | 1 | 10100 | 1 | 15100 | 1 |
| 200 | 2 | 5200 | 2 | 10200 | 2 | 15200 | 2 |
| 300 | 3 | 5300 | 3 | 10300 | 3 | 15300 | 3 |
| 400 | 4 | 5400 | 4 | 10400 | 4 | 15400 | 4 |
| 500 | 5 | 5500 | 5 | 10500 | 5 | 15500 | 5 |
| 600 | 6 | 5600 | 6 | 10600 | 6 | 15600 | 6 |
| 700 | 7 | 5700 | 7 | 10700 | 7 | 15700 | 7 |
| 800 | 8 | 5800 | 8 | 10800 | 8 | 15800 | 8 |
| 900 | 9 | 5900 | 9 | 10900 | 9 | 15900 | 9 |
| 1000 | 0 | 6000 | 0 | 11000 | 0 | 16000 | 0 |
| 1100 | A | 6100 | A | 11100 | A | 16100 | A |
| 1200 | B | 6200 | B | 11200 | B | 16200 | B |
| 1300 | C | 6300 | C | 11300 | C | 16300 | C |
| 1400 | D | 6400 | D | 11400 | D | 16400 | D |
| 1500 | E | 6500 | E | 11500 | E | 16500 | E |
| 1600 | F | 6600 | F | 11600 | F | 16600 | F |
| 1700 | G | 6700 | G | 11700 | G | 16700 | G |
| 1800 | H | 6800 | H | 11800 | H | 16800 | H |
| 1900 | I | 6900 | I | 11900 | I | 16900 | I |
| 2000 | J | 7000 | J | 12000 | J | 17000 | J |
| 2100 | K | 7100 | K | 12100 | K | 17100 | K |
| 2200 | L | 7200 | L | 12200 | L | 17200 | L |
| 2300 | M | 7300 | M | 12300 | M | 17300 | M |
| 2400 | N | 7400 | N | 12400 | N | 17400 | N |
| 2500 | O | 7500 | O | 12500 | O | 17500 | O |
| 2600 | P | 7600 | P | 12600 | P | 17600 | P |
| 2700 | Q | 7700 | Q | 12700 | Q | 17700 | Q |
| 2800 | R | 7800 | R | 12800 | R | 17800 | R |
| 2900 | S | 7900 | S | 12900 | S | 17900 | S |
| 3000 | T | 8000 | T | 13000 | T | 18000 | T |
| 3100 | U | 8100 | U | 13100 | U | 18100 | U |
| 3200 | V | 8200 | V | 13200 | V | 18200 | V |
| 3300 | W | 8300 | W | 13300 | W | 18300 | W |
| 3400 | X | 8400 | X | 13400 | X | 18400 | X |
| 3500 | Y | 8500 | Y | 13500 | Y | 18500 | Y |
| 3600 | Z | 8600 | Z | 13600 | Z | 18600 | Z |
| 3700 | ( | 8700 | ( | 13700 | ( | 18700 | ( |
| 3800 | ) | 8800 | ) | 13800 | ) | 18800 | ) |
| 3900 | ' | 8900 | ' | 13900 | ' | 18900 | ' |
| 4000 | [ | 9000 | [ | 14000 | [ | 19000 | [ |
| 4100 | ] | 9100 | ] | 14100 | ] | 19100 | ] |
| 4200 | * | 9200 | * | 14200 | * | 19200 | * |
| 4300 | = | 9300 | = | 14300 | = | 19300 | = |
| 4400 | < | 9400 | < | 14400 | < | 19400 | < |
| 4500 | > | 9500 | > | 14500 | > | 19500 | > |
| 4600 | $ | 9600 | $ | 14600 | $ | 19600 | $ |
| 4700 | ! | 9700 | ! | 14700 | ! | 19700 | ! |
| 4800 | & | 9800 | & | 14800 | & | 19800 | & |
| 4900 | ? | 9900 | ? | 14900 | ? | 19900 | ? |
| 5000 | % | 10000 | % | 15000 | % | 20000 | % |

# ELEVATION MAP



```
** INPUT CARD: XOBS=22, YOBS=18,COMMENT='THIS IS AN ALTERNATIVE WAY TO SET OBSERVER PUSTION',

   USER REQUEST: XOBS    =        22
XOBS    SET TO           22
   USER REQUEST: YOBS    =        18
YOBS    SET TO           18
   USER REQUEST: COMMEN =
THIS IS AN ALTERNATIVE WAY TO SET OBSERVER POSTION

** INPUT CARD: COMMENT='DEMONSTRATE WEIGHTED VIEW OPTIONS',MTITLE='WEIGHTED$MAP',

   USER REQUEST: COMMEN =
DEMONSTRATE WEIGHTED VIEW OPTIONS
   USER REQUEST: MTITLE =
WEIGHTED     MAP
MAP TITLE IS: WEIGHTED
             MAP

** INPUT CARD: AWON, VIEW, MAP, TABLE, AWOFF, COMMENT='DEFINE DISTANCE WEIGHTING FUNCTION',

   USER REQUEST: AWON
VISIBILITY ANALYSIS WILL BE WEIGHTED BY THE ASPECT OF EACH CELL RELATIVE TO THE OBSERVER.
   USER REQUEST: VIEW




VISIBILITY ANALYSIS WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS:
=====================================================================
         X OBS              22
         Y OBS              18
         RADIUS          1.500   (MILES)
                         2.414   (KILOMETERS)
         DELTA X           .20
         DELTA Y           .17
         SCALE        24000.00
         XMIN                1
         XMAX               36
         YMIN                1
         YMAX               52
         ZANGLE         -90.00
         ZBIAS               0
         SECTORS             0

VISIBILITY WILL BE WEIGHTED BY ASPECT RELATIVE TO THE OBSERVER.


ANALYSIS COMPLETE.
THIS OBSERVER CAN SEE    184 CELLS (     .88 SQUARE MILES,
    563.21 ACRES,    1391.71 HECTARES.)


   USER REQUEST: MAP




MAP OF TIMES SEEN WEIGHTED BY ASPECT RELATIVE TO THE OBSERVER
FOR       1 OBSERVER(S).

EACH CELL IS GIVEN A SCORE OF 0 TO 10 FOR EACH OBSERVER.
THESE ARE CUMULATED OVER OBSERVER POINTS.
FOR DISPLAY THIS SUM IS DIVIDED BY THE NUMBER OF OBSERVERS
SO THAT THE MAP DISPLAYS A NUMBER FROM 0 TO 10 FOR EACH CELL
WHICH IS AN AVERAGE WEIGHTED VIEW OVER ALL OBSERVERS.
```

# WEIGHTED MAP



USER REQUEST: TABLE

TABLE OF TIMES SEEN WEIGHTED BY ASPECT RELATIVE TO THE OBSERVER
FOR 1 OBSERVER(S).

THE NUMBER ASSOCIATED WITH EACH CELL IS THE SUM OF NUMBERS
BETWEEN 0 AND 10 FOR EACH OBSERVER POINT, WHERE A WEIGHT OF 1,
IS ASSIGNED 10, A WEIGHT OF ,5 BECOMES 5, ETC,

| CLASS | CELLS | AREA: SQUARE MILES | ACRES | HECTARES |
|---|---|---|---|---|
| 0 | 1836 | 8,78 | 5619,81 | 13880,85 |
| 1 | 21 | ,10 | 64,28 | 158,64 |
| 2 | 6 | ,03 | 18,37 | 45,38 |
| 3 | 5 | ,02 | 15,30 | 37,82 |
| 4 | 1 | ,00 | 3,06 | 7,56 |
| 5 | 1 | ,00 | 3,06 | 7,56 |
| 6 | 1 | ,00 | 3,06 | 7,56 |
| >7 | 1 | ,00 | 3,06 | 7,56 |

USER REQUEST: AWOFF
WEIGHTING BY ASPECT RELATIVE TO THE OBSERVER IS TURNED OFF,
USER REQUEST: COMMEN =
DEFINE DISTANCE WEIGHTING FUNCTION

== INPUT CARD: NO DWTP, T POINT=(0,5, 1,), TPOINT=(1,0, 0,5), CLEAR, D = ON, VIEW, MAP, TABLE.

USER REQUEST: NODWTP
NO DISTANCE WEIGHT FUNCTION TURNING POINTS, FUNCTION WEIGHT WILL BE 1,0 FOR ALL DISTANCES,
USER REQUEST: TPOINT = ( ,50, 1,00)
DISTANCE WEIGHT FUNCTION TURNING POINT 1 IS AT DISTANCE = ,50 AND HAS A WEIGHT OF 1,00
USER REQUEST: TPOINT = ( 1,00, ,50)
DISTANCE WEIGHT FUNCTION TURNING POINT 2 IS AT DISTANCE = 1,00 AND HAS A WEIGHT OF ,50
USER REQUEST: CLEAR

COUNT FIELD CLEARED FOR CELLS IN THE CURRENT SUBRECTANGLE

USER REQUEST: DWON
VISIBILITY ANALYSIS WILL BE WEIGHED BY THE DISTANCE OF EACH CELL FROM THE OBSERVER
ACCORDING TO THE CURRENT DISTANCE WEIGHTING FUNCTION,
USER REQUEST: VIEW

VISIBILITY ANALYSIS WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS:

| | | |
|---|---|---|
| X OBS | 22 | |
| Y OBS | 18 | |
| RADIUS | 1,500 | (MILES) |
| | 2,414 | (KILOMETERS) |
| DELTA X | ,20 | |
| DELTA Y | ,17 | |
| SCALE | 24000,00 | |
| XMIN | 1 | |
| XMAX | 36 | |
| YMIN | 1 | |
| YMAX | 52 | |
| ZANGLE | -90,00 | |
| ZBIAS | 0 | |
| SECTORS | 0 | |

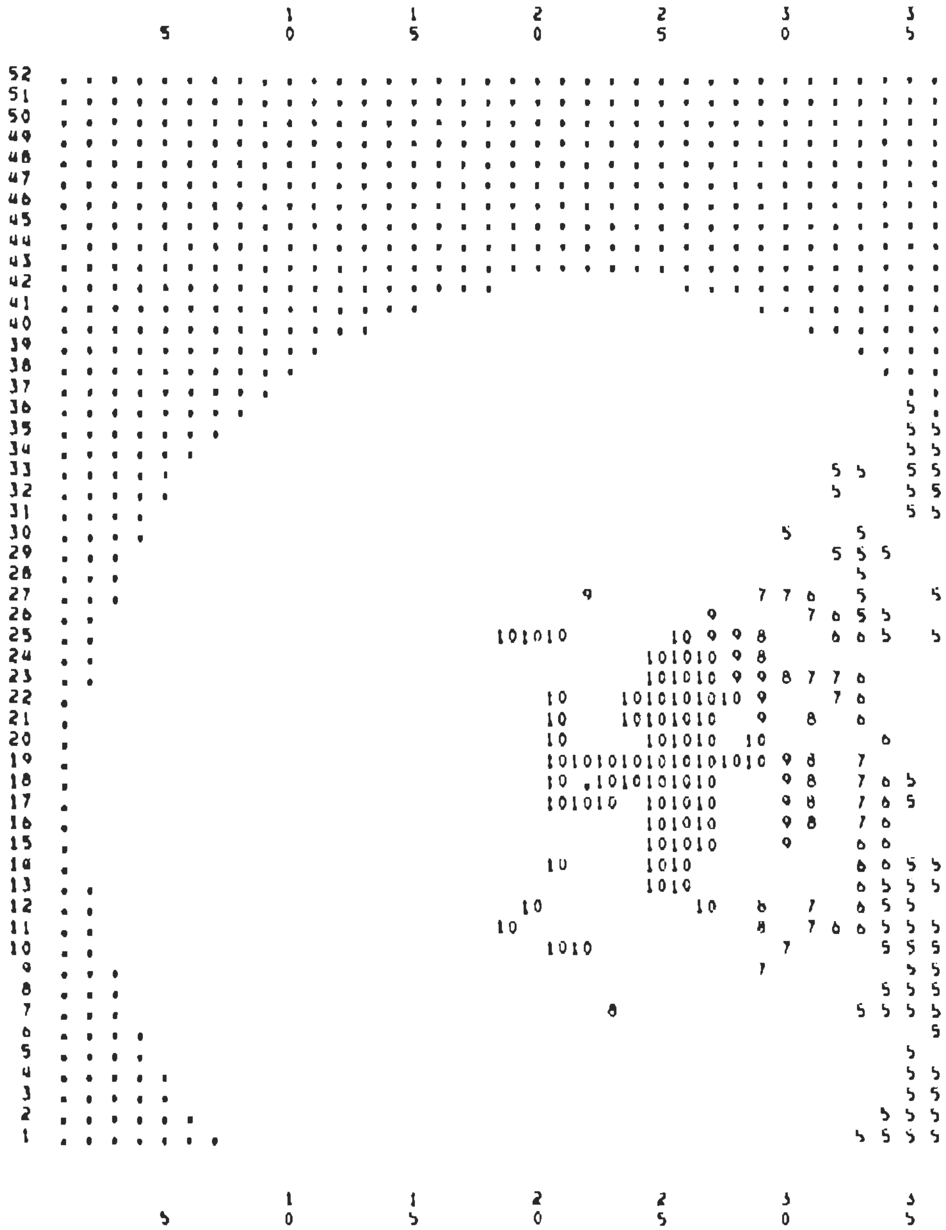
VISIBILITY WILL BE WEIGHTED BY DISTANCE FROM THE OBSERVER,

| DISTANCE | WEIGHT |
|---|---|
| ,50 | 1,00 |
| 1,00 | ,50 |

ANALYSIS COMPLETE,
THIS OBSERVER CAN SEE 184 CELLS ( ,88 SQUARE MILES,
563,21 ACRES, 1391,71 HECTARES,)

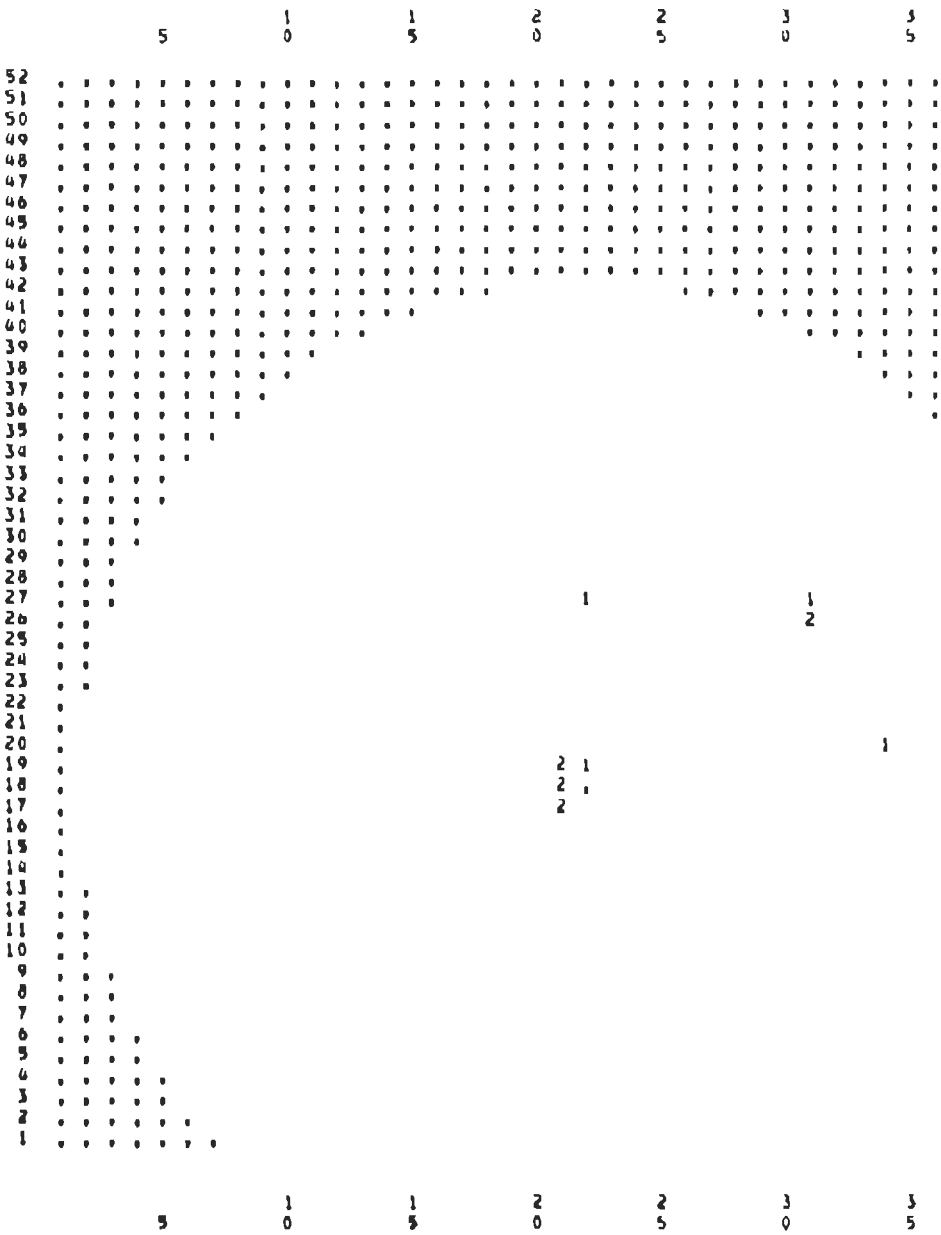
USER REQUEST: MAP

# WEIGHTED MAP



```
** INPUT CARD:  CLEAR,COMMENT='NOW BOTH WEIGHTING METHODS',A = ON,VIEW,MAP,A = OFF, D = OFF.

   USER REQUEST: CLEAR

COUNT FIELD CLEARED FOR CELLS IN THE CURRENT SUBRECTANGLE


   USER REQUEST: COMMEN =
NOW BOTH WEIGHTING METHODS
   USER REQUEST: A=ON
VISIBILITY ANALYSIS WILL BE WEIGHTED BY THE ASPECT OF EACH CELL RELATIVE TO THE OBSERVER.
   USER REQUEST: VIEW



VISIBILITY ANALYSES WILL BE PERFORMED WITH THE FOLLOWING PARAMETERS:
======================================================================
        X OBS               22
        Y OBS               18
        RADIUS           1.500   (MILES)
                         2.414   (KILOMETERS)
        DELTA X            .20
        DELTA Y            .17
        SCALE         24000.00
        XMIN                 1
        XMAX                36
        YMIN                 1
        YMAX                52
        ZANGLE          -90.00
        ZBIAS                0
        SECTORS              0

VISIBILITY WILL BE WEIGHTED BY ASPECT RELATIVE TO THE OBSERVER.

VISIBILITY WILL BE WEIGHTED BY DISTANCE FROM THE OBSERVER.

        DISTANCE               WEIGHT
        -------------------------------
             .50                 1.00
            1.00                  .50


ANALYSIS COMPLETE.
THIS OBSERVER CAN SEE     184 CELLS (     .88 SQUARE MILES,
     563.21 ACRES,    1391.71 HECTARES.)


   USER REQUEST: MAP



MAP OF TIMES SEEN WIEGHTED BY DISTANCE FROM THE OBSERVER
AND BY ASPECT RELATIVE TO THE OBSERVER FOR       1 OBSERVER(S).

EACH CELL IS GIVEN A SCORE OF 0 TO 10 FOR EACH OBSERVER.
THESE ARE CUMULATED OVER OBSERVER POINTS.
FOR DISPLAY THIS SUM IS DIVIDED BY THE NUMBER OF OBSERVERS
SO THAT THE MAP DISPLAYS A NUMBER FROM 0 TO 10 FOR EACH CELL
WHICH IS AN AVERAGE WEIGHTED VIEW OVER ALL OBSERVERS.
```

# WEIGHTED MAP



```
   USER REQUEST: A=OFF
WEIGHTING BY ASPECT RELATIVE TO THE OBSERVER IS TURNED OFF.
   USER REQUEST: D=OFF
DISTANCE WEIGHTING IS TURNED OFF.

** INPUT CARD:  COMMENT='DEFINE SOME SLOPE CLASSES.'.

   USER REQUEST: COMMEN =
DEFINE SOME SLOPE CLASSES.

** INPUT CARD:  CLASS(1)=(0.,25.), CLASS(2)=(25.,50.),CLASS(3)=(50.,1000.), N CLASS=3.

   USER REQUEST: CLASS (     1) = (        .00,       25.00)
CLASS(  1) WILL BE FROM        .00 TO      25.00
   USER REQUEST: CLASS (     2) = (      25.00,       50.00)
CLASS(  2) WILL BE FROM      25.00 TO      50.00
   USER REQUEST: CLASS (     3) = (      50.00,     1000.00)
CLASS(  3) WILL BE FROM      50.00 TO    1000.00
   USER REQUEST: NCLASS =        3
NCLASS SET TO              3

** INPUT CARD:  COMMENT='FOR SLOPE, CLASSES ARE TAKEN AS SLOPES IN PERCENT'.

   USER REQUEST: COMMEN =
FOR SLOPE, CLASSES ARE TAKEN AS SLOPES IN PERCENT

** INPUT CARD:  MTITLE='USER SLOPE MAP'.

   USER REQUEST: MTITLE =
USER SLOPE  MAP
MAP TITLE IS: USER SLOPE
              MAP

** INPUT CARD:  U SLOPE, TABLE, MAP.

   USER REQUEST: USLOPE

SLOPE CALCULATED BY USER-SPECIFIED CLASSES


   USER REQUEST: TABLE


TABLE OF SLOPE BY USER-DEFINED CLASSES.

CLASS   LOWER LIMIT   UPPER LIMIT
-----   -----------   -----------
  1           .00         25.00
  2         25.00         50.00
  3         50.00       1000.00


       CLASS                 CELLS        AREA:  SQUARE MILES        ACRES      HECTARES
==========================================================================================
         1                   1272                        6.08      3891.48      9620.96
         2                    567                        2.71      1735.54      4288.59
         3                     33                         .16       101.01       249.60
==========================================================================================



   USER REQUEST: MAP



MAP OF SLOPE BY USER-SPECIFIED CLASSES.

CLASS   LOWER LIMIT   UPPER LIMIT
-----   -----------   -----------
  1           .00         25.00
  2         25.00         50.00
  3         50.00       1000.00
```

# USER SLOPE MAP

| | | | | | 5 | | | | | 10 | | | | | 15 | | | | | 20 | | | | | 25 | | | | | 30 | | | | | 35 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 51 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 50 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 49 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 48 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 47 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 45 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 44 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| 43 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| 42 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| 41 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| 40 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| 39 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| 38 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| 37 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 |
| 36 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| 35 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| 34 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| 33 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 |
| 32 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| 31 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 29 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 28 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 1 | 1 | 1 |
| 27 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 |
| 26 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 2 | 3 | 1 | 1 | 1 |
| 25 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 24 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 23 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 21 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| 19 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 17 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 16 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 15 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 14 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 13 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 12 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | | 5 | | | | | 10 | | | | | 15 | | | | | 20 | | | | | 25 | | | | | 30 | | | | | 35 | |

```
** INPUT CARD:  COMMENT='NOW CALCULATE SLOPE BY THE MAXIMUM SLOPE METHOD', U X SLOPE,

   USER REQUEST: COMMEN *
NOW CALCULATE SLOPE BY THE MAXIMUM SLOPE METHOD
   USER REQUEST: UXSLOP

MAXIMUM SLOPE CALCULATED BY USER-SPECIFIED CLASSES.


** INPUT CARD:  TABLE, MAP,

   USER REQUEST: TABLE


TABLE OF MAXIMUM SLOPE BY USER-DEFINED CLASSES.

CLASS   LOWER LIMIT    UPPER LIMIT
-----   -----------    -----------
  1            .00          25.00
  2          25.00          50.00
  3          50.00        1000.00


        CLASS                CELLS        AREA:  SQUARE MILES          ACRES      HECTARES
==========================================================================================
          0                     4                         .02          12.24         30.25
          1                   512                        2.45        1567.19       3872.59
          2                  1084                        5.18        3318.03       8198.99
          3                   272                        1.30         832.57       2057.31
==========================================================================================



   USER REQUEST: MAP




MAP OF MAXIMUM SLOPE BY USER-SPECIFIED CLASSES

CLASS   LOWER LIMIT    UPPER LIMIT
-----   -----------    -----------
  1            .00          25.00
  2          25.00          50.00
  3          50.00        1000.00
```