

Visual Management Support System¹

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Abstract: The Visual Management Support System (VMSS) is an extension of an existing computer program called VIEWIT, which has been extensively used by the U. S. Forest Service. The capabilities of this program lie in the rapid manipulation of large amounts of data, specifically operating as a tool to overlay or merge one set of data with another. VMSS was conceived to computerize map overlaying tasks of the Visual Management System. It is also useful for any project that requires interaction of one or more maps to result in an output map expressing evaluation or interpretation information. VMSS inputs may be from maps or data files that are not landbase associated. This paper deals with VMSS as a tool in visual resource management data manipulation, and explores the application of VMSS on the Klamath National Forest. Sample overlay processes, sample runstreams, problems in implementation and the strengths of VMSS are discussed.

INTRODUCTION TO VMSS

VMSS, a small, fairly specialized grid type computer program, is intended to support the U. S. Forest Service Visual Management System, and is capable of reading one or two input data files. For example, input files may contain information about scenic quality, visible areas, distance zones, visual absorption capability, demographic data, and so on. With one input file, the file can be transformed into a second file (Fig. 1). With two files, they can be merged, or overlaid, to make a third file (Fig. 2). This new file

can be printed as an alpha-numeric map, printed as a gray scale (overprinted) map and/or saved on an output file. An acreage table can also be printed as an output.



Figure 1--The "transform" option of VMSS allows data (File 1) to be simply relabeled or sorted into groups as specified by the decision matrix. File 2 is the resulting output of the transform process.

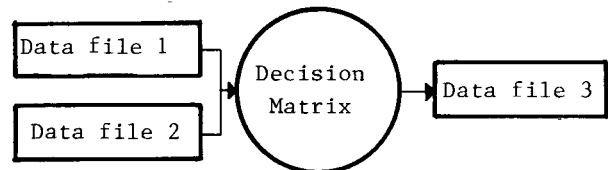


Figure 2--The "merge" process of VMSS interfaces data files 1 and 2 according to the specifications of the decision matrix.

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BACKGROUND

During the last decade, the public has demanded a variety of amenity values from the National Forests, as well as a supply of products such as timber and range. As a result, scenery is now a recognized resource in these forests, and is presently managed under the Forest Service Visual Management System that was established in 1974. The Visual Management System establishes methods for inventorying and mapping variety classes and sensitivity levels and determining visual quality objectives. Visual quality objectives express the relative importance of visual resources in the National Forests based on the land's intrinsic scenic quality (variety classes) and its sensitivity to public viewing pressures (sensitivity levels). The development of visual quality objectives is just the first step in visual resource management. Land managers must also appreciate how difficult, or easy, it may be to achieve those objectives on different units of land.

Visual absorption capability (VAC) establishes a methodology to determine the feasibility of meeting the visual quality objectives. VAC is an analytical process which identifies the landscape's susceptibility to visual change and measures the land's ability to absorb alteration while retaining its visual integrity.

The end product of the visual resource analysis is a map of visual management classes (VMC) and guidelines for visual resource manage-

ment. A VMC map consists of a discrete visual objective, distance zone(s) and visual absorption capability rating (fig. 3). Visual management classes stratify landscapes in a continuum from visually vulnerable to visually tolerant. The most visually vulnerable landscape is "retention-foreground with a low VAC"; the most tolerant landscape is "maximum modification seldom seen with a high VAC."

NEED FOR VMSS

After 1974, landscape architects on the 17 National Forests in California began a process of inventorying and mapping variety classes, user sensitivity, visible areas, distance zones, and visual quality objectives following the procedures outlined in Agriculture Handbook 462.

It soon became obvious, however, that it was a very difficult and time-consuming task to map seen areas accurately by hand. A computer program which analyzes seen areas based on digitized topographic data was instituted on several National Forests to aid in the mapping process. This program, called VIEWIT, is a computerized technique of delineating the terrain visible from one or more points (see User's Guide, USDA Forest Service General Technical Report PSW-11/1975). These seen area maps were manually combined with variety class maps to produce visual quality objective (VQO) maps (fig. 4). This manual overlaying was very time consuming.

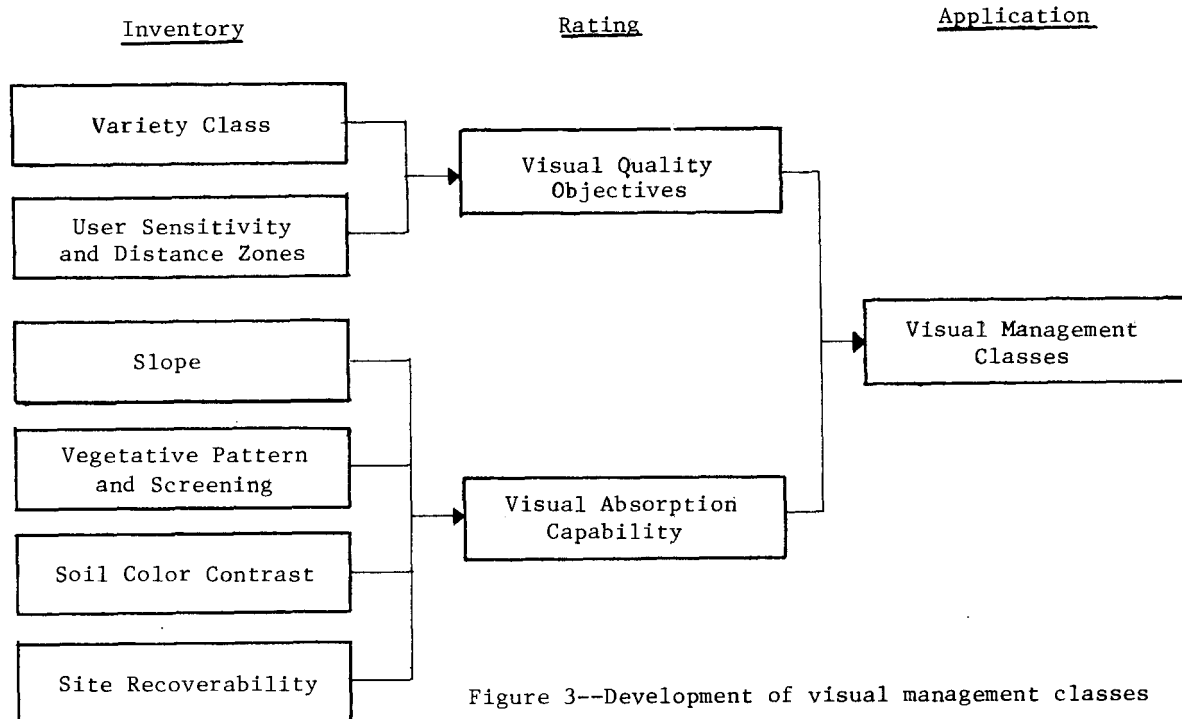


Figure 3--Development of visual management classes

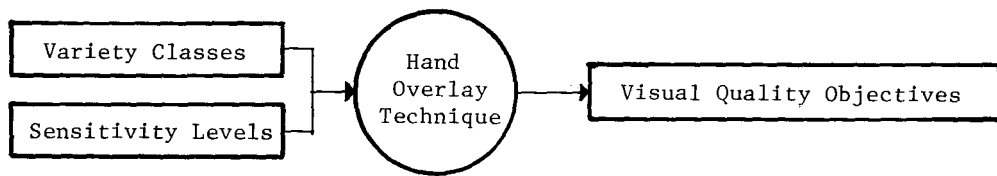


Figure 4

This approach was a tedious process which required many hundreds of hours working over a light table to prepare VQO maps. During this same time, several breakthroughs occurred which expanded the usefulness of VIEWIT. These included a distance and sensitivity level weighting of the seen area maps, and a gray scale map to display outputs graphically. These refinements in the VIEWIT program further emphasized the need to computerize fully the visual management system, including the VQO, the VAC, and the VMC processes. Several Region 5 landscape architects as well as personnel from the Pacific Southwest Forest and Range Experiment Station met and discussed the need to develop such a system. Subsequently, the Visual Management Support System (VMSS) was developed to respond to this need.

KLAMATH NATIONAL FOREST APPLICATION OF VMSS

The Klamath National Forest is located in Northern California and Southern Oregon on approximately 1.7 million acres of land. Its lands are among the steepest, most rugged, and remote in California. These characteristics prompted us to explore various methods of visual resource mapping. One alternative was to map seen areas and variety class completely in the field. Another alternative was to calculate seen areas by plotting topographic cross-sections in the office. Because of the complex and remote land base, however, it soon became obvious that such approaches were both impractical and costly. Therefore, the selected alternative was to digitize topographic data from the Defense Mapping Agency Tapes and utilize VIEWIT to compute seen areas and distance zones. Variety classes were mapped from aerial photographs and then field verified. VMSS was formulated and implemented to combine seen areas, distance zones, and variety classes to make a VQO map. It soon became apparent that VMSS had other applications such as producing VAC maps from ecological land units and VMC maps from VQO and VAC data.

VMSS was designed to be compatible and

supplemental to the VIEWIT computer program. As such, it is necessary to explain some of the basic attributes of the VIEWIT program as applied on the Klamath National Forest.

VIEWIT uses a rectangular grid cell which is 1/5-inch wide and 1/6-inch high. This cell size accommodates two alpha/numeric characters per cell. The digitized terrain data base can be overlaid by a topographic map. The map scale ratio we selected was 1:24,000 and therefore each cell is 3.06 acres in size. Different map scales are possible depending on how the terrain data are digitized. Outputs which are possible from the VIEWIT program include seen area maps from one or more observer positions, slope maps, aspect maps, elevation maps, aspect relative to observer maps, slope relative to observer maps, profiles, and acreage tables. Some of the outputs, such as seen area distance zone maps, can be printed either as a numeric map or a gray scale map.

On the Klamath, we utilized VIEWIT to map seen areas from visually sensitive roads, rivers, and use areas. These seen areas were stratified into distance zones of foreground (0 to 3/8 mile), middleground (3/8 to 4 miles), and background (4 miles plus). The output was a gray scale map of seen area/distance zones.

Subsequently, variety class was digitized at the same scale and cell size as the digitized terrain data. Variety classes were mapped as polygons and converted to 1/5 x 1/6 inch grids by the VMSS Digitizer Support System (DGRID). The computerized seen area/distance zone and variety class data were then merged as defined by the decision matrix (page 43 of Agriculture Handbook 462), to create visual quality objective-distance zone maps. These quality objective-distance zone maps were stored in a data file to allow us to combine them with VAC data to create visual management class maps using VMSS.

In the merge example (fig. 5), file 1 is the output file from the VIEWIT seen area analysis. A gray scale map is produced from

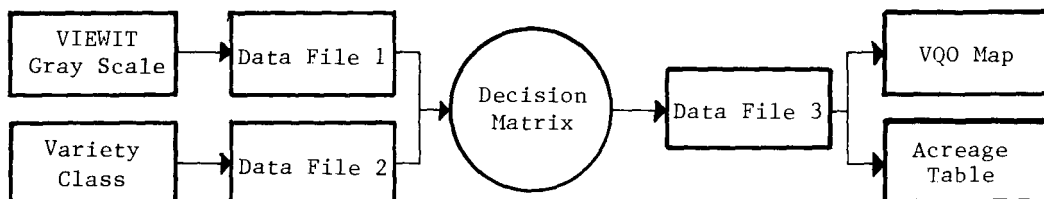


Figure 5

the data before they are stored in file 1. This gray scale map serves as a graphic display of sensitivity levels and distance zones so we can check the accuracy of the VIEWIT run.

File 2 is produced by the VMSS Digitizer Support System from maps of variety class polygon areas. The Digitizer Support System (DGRID) converts these polygons to the same grid as used in VIEWIT (1/5" x 1/6"). The VMSS program then passes files 1 and 2 through a decision matrix which instructs a value in file 1 to be combined with a value in file 2 which then becomes a new value in file 3. The VQO matrix on page 43 of Agriculture Handbook 462 is the decision

matrix. File 3 is then printed as a map and an acreage table.

Another use of VMSS is the combination of two VIEWIT seen area maps of the same lands to make a "highest sensitivity level" map (fig. 6)

VMSS can also transform the labels on file 1 to a new label on output file 2 (fig. 7).

VMC MAP PREPARATION

To prepare a visual management class (VMC) map using VMSS, the following 3-step procedure would be used (figs. 8, 9, 10).

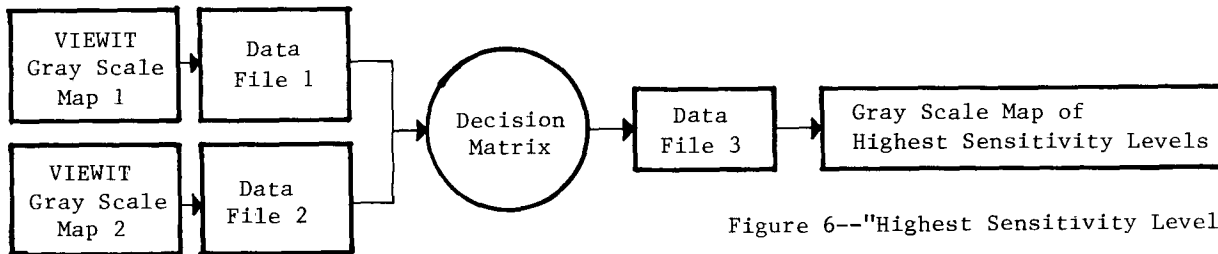


Figure 6--"Highest Sensitivity Level" Map

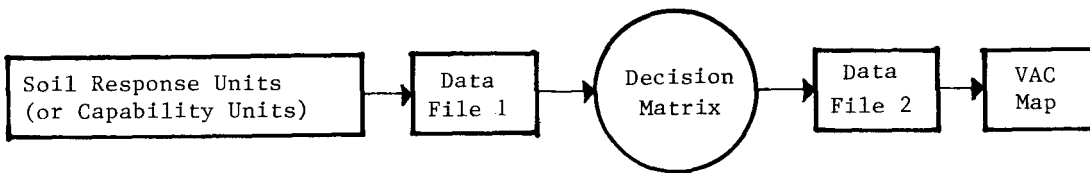


Figure 7--VAC Map

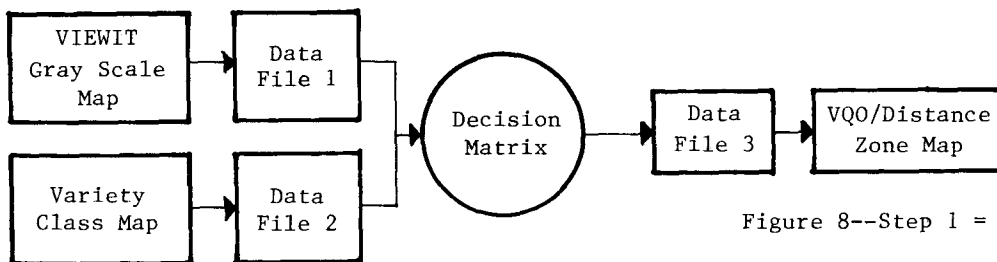


Figure 8--Step 1 = VQO Map

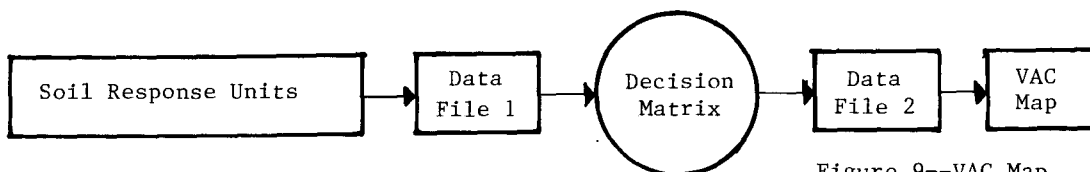


Figure 9--VAC Map

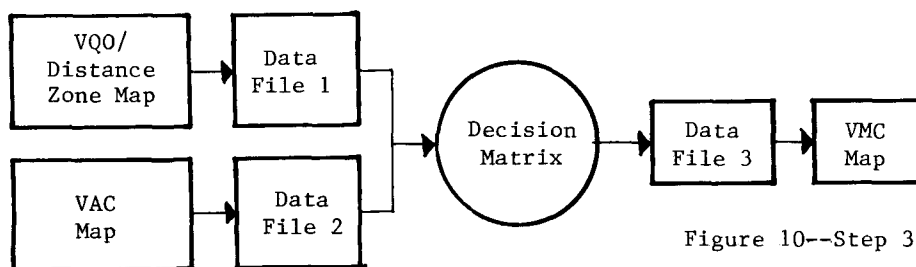


Figure 10--Step 3 = VMC Map

HARDWARE REQUIRED

VMSS requires access to a large memory computer, a digitizer, an intelligent terminal, a high-speed line printer, a data storage system, and a modem. The Klamath National Forest has telephone access to the USDA's Univac 1100-42 computer at Fort Collins, Colorado. On the Forest, there is a Numonics digitizer with a 24" x 24" working area, set up to communicate with an ICL intelligent terminal. The printer is a high-speed ICL 1556. The minimum hardware required to run VMSS is a digitizer, intelligent terminal, high-speed printer, and a modem.

SAMPLE RUNSTREAMS

To prepare a VQO map from an existing file with VIEWIT seen area/distance zone data and another existing file with digitized variety class data, the following runstream would be used. The VIEWIT data are called element "G617" in the file "SENSITIVITY." The variety class data are called element "H7" in the file "VAR-CLASS." See lines 10 and 14 of the following sample runstream. The decision matrix (lines 29-36) specifies the labels to be used in file 3 as a result of each possible combination in the overlay process.

SAMPLE RUNSTREAM FOR USE AT FORT COLLINS COMPUTER CENTER

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@RUN . . .
  Standard runcard format
1:@SYM PRINT$,, FCR051
  This line identifies our site I.D.
  number.
2:@MSG,N RECOMMENDED VQO FOR H7
  Print the following message at the
  beginning of the computer printout.
3:@ASG,A PSW*VIEWIT
  Assign the VIEWIT program.
4:@ASG, AX SENSITIVITY.
  Assign the previously cataloged file
  SENSITIVITY, and give this run exclu-
  sive use of the file.
5:@ASG, A VAR-CLASS.
  Assign the previously cataloged file
  VAR-CLASS.
6:@ASG,T T1
  Assign a temporary file called "T1."
7:@ASG,T T2
  Assign a temporary file called "T2."
8:ASG,T T3
  Assign a temporary file called "T3."
9:@DATA, I T1.
  Add the following data to T1, initial
  insertion, previous data in the file
  will be written over.
10:@ADD,D SENSITIVITY.G617
  Add element G617 from the file
  SENSITIVITY to T1.
11:@END
  End of data insertion.
12:@FREE SENSITIVITY
  Free file for use by other runs.
13:@DATA,I T2.
  Add the following data to "T2."
14:@ADD,D VAR-CLASS.H7
  Add the element "H7" from the file
  "VAR-CLASS" to file "T2."
15:@END
  End of data insertion.
16:@XQT PSW*VIEWIT.VMERGE
  Run the VMERGE (VMSS) process of the
  VIEWIT program.
17:TITLE ='RECOMMENDED VQO FOR H7'.
  Title printed on top of each page of
  output.
18:REMARK = 'FILE 1 IS SENS.LEVEL FROM VIEWIT'.
  Remarks for user's information only,
  not used in run.
19:FILE (1): NAME ='T1'.
  Begin definition for file "T1."
20:NCOLS=240,NROWS=432.
  Number of rows (NROWS) and columns
  (NCOLS)
21:XOFF =120,YOFF =144.
  Defines by row and column lower left
  corner of data sub-rectangle. See
  fig. 1. File 1 432 rows high and 240
  columns wide. The sub-rectangle we
  want is Area B. The XOFF and YOFF
  define Point C. The XUSE and YUSE
  define the size of Area B.
  
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STRENGTHS OF VMSS

Four of the biggest strengths of VMSS are:

1) The ability to computerize a mapping process which is rote (non-creative) with the possibility of making broad changes very quickly. Such changes with short turn-around times will often occur with National Forest land and resource management planning efforts. Visual effects of Forest Service alternative plans or alternatives suggested by the public can be accurately and quickly mapped with VMSS. Such effect predictions would be very difficult and time consuming to prepare accurately by hand.

2) The capability to make a grid map from a polygon map.

3) The ability to combine parts of two maps into a third map.

4) The transferability of VMSS. Although VMSS was originally intended to support only the Visual Management System to make a VQO, VAC, or VMC map, it can also be used to combine soils, vegetation, demographic or other mapped data to prepare virtually any overlaid output map that may be desired. Therefore, disciplines other than landscape architects will become more interested in VMSS as time goes on.

PROBLEMS ENCOUNTERED WITH VMSS

Some of the problems we have encountered with VMSS are:

1) The process of digitizing variety class is subject to human and hardware errors. This has caused us both to re-digitize variety class maps and to "patch" errors in the variety class data file. Other users who have digitized vegetative type maps have experienced the same problem. We would speculate that these problems occur because the digitizer operator goes too fast and creates errors by omitting line segments and labels or by introducing extraneous line segments which create unlabeled polygons. Also, the hardware (Numonics digitizer and ICL

terminal) may be responsible for some of the errors.

2) Small polygons create difficulties in digitizing because it is often difficult to enclose these polygons with line segments and then fit a label within them. If the label is located on the same coordinates as a line segment, the label will be ignored, which results in an error.

3) VMSS, like any other batch program, is very literal. If a "comma" is placed in a runstream where a "period" is required, the entire runstream will fail. Also, a certain knowledge of computer "jargon" is required to run any batch program.

4) "Patches" are made in a batch mode. Therefore, if the "corrected" digitized map is not error free, it is difficult to know if original errors were not corrected or if the patches created new errors, or both.

5) It takes a considerable amount of time and effort to digitize successfully. After various data files are successfully digitized, it is very easy to use VMSS to merge repeatedly or transform these files into new files.

CONCLUSION

We think that the payoff of using VMSS will come during the alternative formulation and evaluation stages of land management planning. These evaluations will require rapid manipulation of data for many alternatives.

The Visual Management Support System offers increased accuracy and flexibility in visual resource planning and management. This is accomplished by allowing the user quickly to manipulate data files in the alternative evaluation stages of broad-scale land planning. It also allows the user accurately and quickly to assess visual resource outputs of various land allocation proposals.