FORPLAN PLOTTING SYSTEM (FORPLOT)

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ABSTRACT

The National Forest Management Act (NFMA) of 1976 requires the Forest Service to carry out integrated planning on all National Forest System lands. Resource planning includes three areas of interest: land allocation, output scheduling, and spatial analysis. The main tool for allocation and scheduling is the Forest Planning Model (FORPLAN), primarily a linear programming model. Its outputs are used in determining how specific management practices should be applied to an area in order to best utilize available resources.

The purpose of the FORPLOT mapping system is to produce map overlays showing FORPLAN-assigned prescription labels (labels indicating how Forest areas should be used) in a user-specified area. By placing FORPLOT-generated overlays over topographical maps, Forest Service land use planners can quickly and easily ascertain how to manage a given section of the Forest (according to the FORPLAN linear programming model).

Each Forest area is broken down into analysis areas consisting of one or more noncontiguous Forest sections possessing similar characteristics. Each analysis area section is called a "polygon" and is labeled according to FORPLAN-assigned management descriptors (prescription labels).

FORPLOT merges a data file containing FORPLAN-assigned prescription labels with a data file containing the geographic coordinates for analysis areas and their associated polygons. FORPLOT then produces a data file containing both prescription labels and the locations where those labels should appear on the map. Map overlays are then produced on either a line printer or a plotting device such as a drum plotter.

BACKGROUND

Prior to the National Forest Management Act of 1976 (NFMA) the different specialists on the National Forests went about their planning efforts almost independently of one another. Timber Management Specialists had developed some harvest scheduling systems to aid them in their planning. Land Management Planning Specialists had come up with various linear programming formulations and structures to do their unit plans. The other specialists had their own analytical tools, but there was no single controlled effort to perform integrated planning. NFMA changed all that and required the Forest Service to conduct integrated planning on all the national forest lands. There were several approaches that were being proposed to perform the planning analysis. In reviewing existing programs, it was determined that they could be modified to handle most of the analytical approaches that were needed. As a result, the FORPLAN system had its origin from these existing programs.

FORPLAN System. FORPLAN is a computerized forest planning system to aid land managers in their decision making process. The FORPLAN system consists of a matrix generator, a linear programming (LP) algorithm, and a report writer. The matrix generator generates a matrix of scheduling activities and the linkages required to combine the two individual matrices into one for solving. The matrix for the allocation portion of the problem must be generated by user-developed generators. The LP algorithm is derived from UNIVAC's Functional Mathematical Programming System (FMPS). The report writer is the most important part of the system for the land manager. It interprets the solution which comes out of the LP algorithm and generates a series of tables and graphs which depicts where (in a general sense), when, and how much land is required to meet the targets or objectives. It also produces the output file containing the descriptive data necessary for input to FORPLOT.

FORPLAN PLOTTING SYSTEM (FORPLOT)

Overview. With the adoption of FORPLAN as the primary tool for resource planning and utilization, there developed a need to gain a spatial insight as an additional tool in the process of allocating forest resources. This can be accomplished by an overlay upon which the FORPLAN solution set can be drawn. The purpose of FORPLOT is to produce map overlays showing FORPLAN assigned prescription labels in a user specified area. By placing the FORPLOT generated overlays over topographical maps, Forest Service land use planners can quickly and easily ascertain how to manage a given section of the forest according to the FORPLAN LP solution.

Each forest area is broken down into Analysis areas (AA) which consist of one or more Capability areas (CA). Each CA of an AA is referred to as a polygon. These polygons are labeled according to the management descriptors (prescription labels) assigned by FORPLAN.

CA's are defined as the smallest homogeneous land area used to describe characteristics of the land and resources in an integrated forest plan and are delineated using established Forest Service guidelines. AA's consist of contiguous and non-contiguous CA's combined for the purpose of analysis in formulating alternatives and estimating impact and effects.

FORPLOT merges a data file containing FORPLAN assigned prescription labels with a data file containing geographic coordinate pointers for AA's and their associated polygons (AA file). FORPLOT then produces a data file containing both prescription labels and the location where those labels should appear on the map. The map overlays can be produced on either a line printer or a plotting device such as a drum plotter.

The FORPLOT mapping system is made up of three separate programs: FORPLOT, PTPLOT, and DPPLOT. FORPLOT is the program which merges the FORPLAN file and AA file, prepares the label plot file, and produces printed reports. PTPLOT is the program which generates a printed map overlay and DPPLOT is the program which produces map overlays on a specified plotting device. Figure 1 is a general flow diagram that depicts the FORPLOT mapping system.

FORPLOT Program. FORPLOT is the main program of the FORPLOT mapping system. It is used to generate the label plot file, which contains polygon coordinates prescription labels and/or indexes where applicable. Indexes are generated in place of prescription labels if there are too many labels assigned to a single position, if labels from one polygon will overlap those of another, or the area of a polygon is smaller than the minimum area that can be labeled.

Input. There are two types of input entered to run the FORPLOT program, required parameters and optional parameters. Required parameters include a file containing the FORPLAN produced prescription labels, a file containing the geographic coordinates of a point within each polygon, the name of the file to which the label plot records are to be written, and values to define the area to be mapped. Optional parameters include values to be used in scaling the map, the character size of the prescription labels and indexes, the minimum size a polygon may be in order to be labeled on the map, the maximum number of prescription labels that can appear over any one polygon, special character codes, and names of the files in which the printed report and error messages are to be placed.

Output. Output generated by the FORPLOT program are the label plot file containing the labels and indexes that are to appear on the map (and their locations on the map), the parameters entered during the session, computerd values used to produce the map, and a printed report. The report consists of four parts; a list of the parameters entered or computed during the session (Figure 2), a Dictionary Report listing the prescription labels on the map (Figure 3), a Prescription List (PLIST) listing all the indexes on the map and prescription labels that would have been printed in place of the indexes (Figure 4), and a Coordinate List (CLIST) listing the coordinates, in map inches, of prescription labels that could neither be plotted or indexed on the map (Figure 5).

FORPLOT GENERAL FLOW CHART

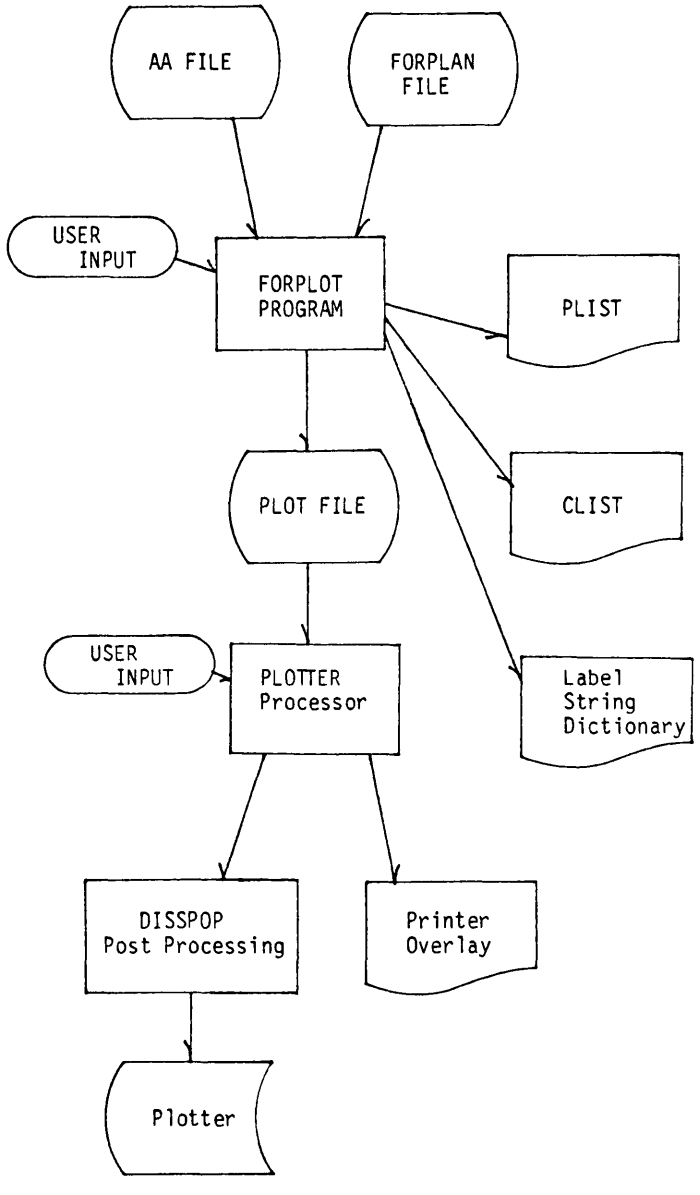

Figure 1

PTPLOT Program. PTPLOT is the program which prdduces map overlays on a high speed line printer or printing terminal. It generates the prescription label map overlay, using data obtained from the label plot file. The output generated by this program is a line printer map overlay (Figure 6).

DPPLOT Program. DPPLOT is the program which produces map overlays on a specified graphic output device. The output devices on which map overlays can be directly produced are; Tektronix 4010 Series terminals, Zeta plotters, and Hewlett-Packard 722] plotters. Additionally, DPPLOT can produce a file which can be used by a preprocessor program to produce map overlays on additional graphic output devices. DPPLOT generates a map overlay by using the data in the label plot file.

Input. DPPLOT also uses both required and optional parameters to input data and map specifications. The required parameters must be the filename of the label plot file generated by the FORPLOT program. Optional parameters include the name of the graphic output device on which the plot is to be produced, and various parameters to define the exact way the map overlay is to appear.

Ouput. The output generated by the program is a plotted map overlay (Figure 7), or a file which can be sent to a post-processor for later plotting on other graphic output devices supported by the USDA Fort Collins Computer Center, located at Fort Collins, CO.

CONCLUSION

FORPLOT is designed to produce map overlays showing FORPLAN assigned prescription labels in a user-specified area. These overlays are plotted quickly and automatically. The planner can then visually determine the feasibility of a FORPLAN solution and make the appropriater allocations of land to meet Forest Service resource planning objectives.

REFERENCES

_____1981, FORPLAN Mapping System (FORPLOT) User Manual, USDA Forest Service

_____1981, FORPLAN User's Manual, USDA Forest Service

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F O R P L O T  P R O G R A M                          VERSION - 10/1/81

US FOREST SERVICE                                    * * * * * * * * * *
DATE:  OCT 20, 1981                                  *  F O R P L O T  *
TIME:  11/50/20                                      * * * * * * * * * *


                    INPUT PARAMETER LIST

TITLE:  SAMPLE MAP USED FOR RUN COST ESTIMATES
FORPLOT FILE:  LMP*PLOTF.
AA FILE:       LMP*AAQUAD.
PLOT FILE:     LABFILE.

       5000.000 = XSCALE              5000.000 = YSCALE
         39.850 = SW LAT               105.870 = SW LONG
         39.921 = NE LAT               105.800 = NE LONG
           .100 = XCELL                    .167 = YCELL
         -1.000 = ACRES                     3   = NOP


                    RUN STATISTICS

            38 = NUMBER OF POLYGON RECORDS IN AA FILE
            28 = NUMBER OF POLYGONS WITHIN MAP WINDOW
            39 = NUMBER OF ANALYSIS AREAS IN MAP WINDOW
             0 = NUMBER OF ANALYSIS AREAS NOT IN FORPLAN
            31 = NUMBER OF LABELED POLYGONS
             3 = NUMBER OF INDEXED POLYGONS (MAY BE LABELED)
             6 = NUMBER OF POLYGONS NOT LABELED/INDEXED (IN CLIST)
            70 = NUMBER OF DICTIONARY ENTRIES

         4.000 = MAP LENGTH              5.17 = MAP HEIGHT

AA FILE HEADER:  DATA SUPPLIED BY GEOMETRONICS DIVISION, U.S.F.S.


NOTE:  ONLY THE FIRST ACTIVE TIME PERIOD IS SELECTED FOR EACH PRESCRIPTION.
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FIGURE 2

PRESCRIPTION LABEL DICTIONARY

TYPE E = MANAGEMENT EMPHASIS
TYPE I = MANAGEMENT INTENSITY

TYPE	VALUE	MANAGEMENT DESCRIPTOR
E	1	MINLVL
E	2	GENFOR
E	3	SC/REC
E	4	SP INT
E	5	UR REC
E	6	W-SCMA
E	7	W-WINT
E	8	W-DIVR
E	9	W-SMU
E	A	WILDER
E	B	NO URB
I	!	54
I	"	39
I	#	48
I	$	51
I	%	47
I	&	57
I	'	50
I	(	41
I	)	49
I	*	43
I	+	55
I	,	42
I	-	59
I	.	1
I	/	2
I	0	3
I	1	4
I	2	5
I	3	6
I	4	7
I	5	8
I	6	9
I	7	10
I	8	52
I	9	58
I	:	44
I	;	45
I	<	46
I	=	
I	>	

FIGURE 3

PLIST - PRESCRIPTION LIST

INDEX	AAID	POLYGON ID	POLYGON AREA (ACRES)	* * * * * * * * PRESCRIPTION LABELS
A1	82	1401	168.	2C11 2C22
A2	130	2301	60.	2.19
A3	70	1501	440.	2D70 2HA5

FIGURE 4

CLIST - COORDINATE LIST

AAID	X (INCHES)	Y (INCHES)	POLYGON ID	POLYGON AREA (ACRES)	* * * * * * PRESCRIPTION LABELS
75	2.13	4.50	20401	15.	2359
84	2.20	1.67	11302	128.	2499
85	3.00	4.00	1303	39.	2L29
90	2.50	3.50	5401	92.	2L20 2P49
91	1.10	1.17	3302	23.	1119
92	2.10	3.50	3301	112.	2159

FIGURE 5

DATE: OCT 22, 1981 TIME: 07/37/37 F O R P L O T PRINTER PLOT PART: 1

SAMPLE MAP USED FOR RUN COST ESTIMATES

5000.0 = YSCALE	39.8500 = SWLAT	39.9210 = NELAT	.1000 = XCELL	-1.0 = ACRES	4.00 = XSIZE
5000.0 = XSCALE	105.8700 = SWLONG	105.8000 = NELONG	.1667 = YCELL	3 = NOP	5.17 = YSIZE

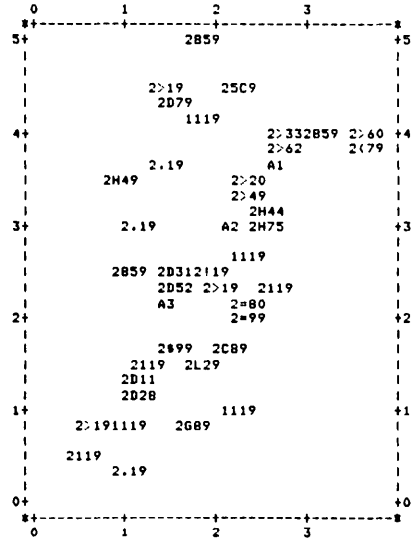

FIGURE 6

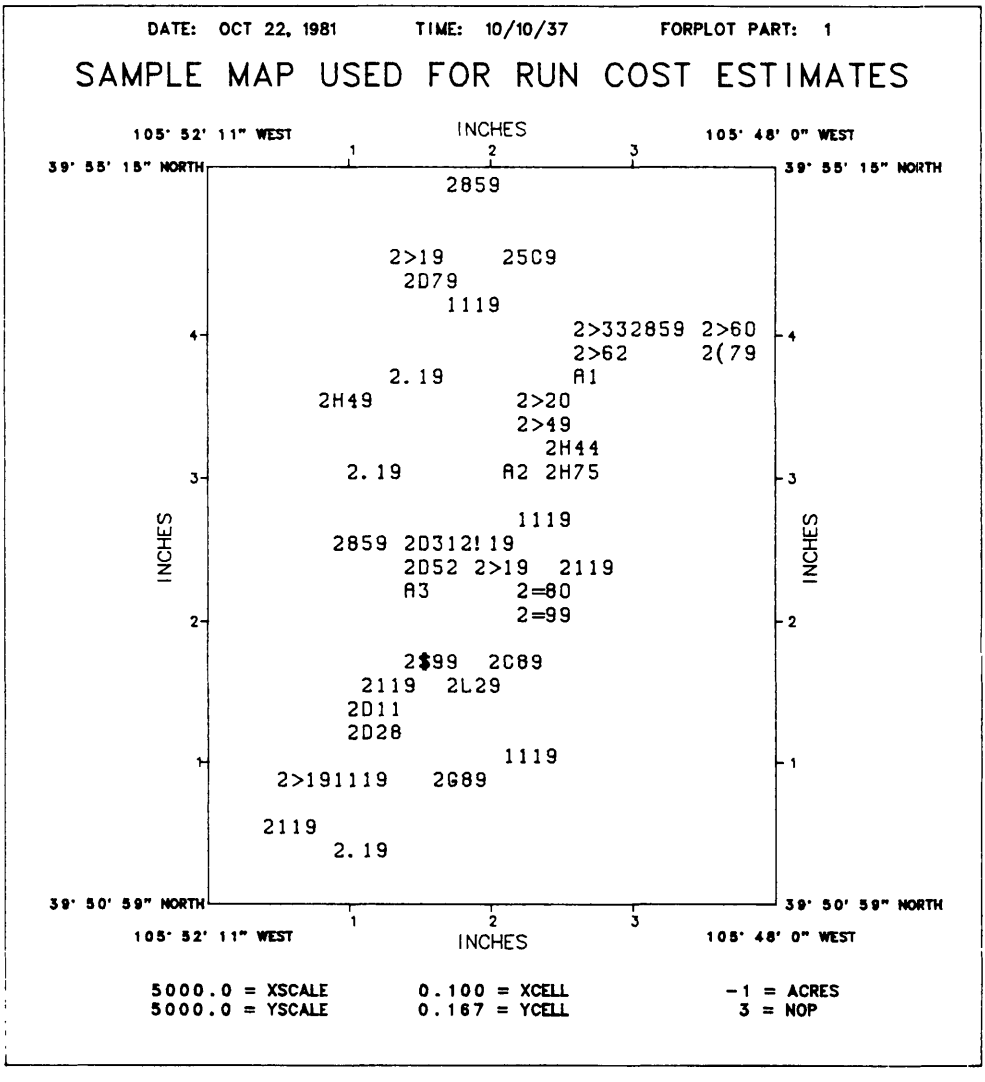
DATE: OCT 22, 1981 TIME: 10/10/37 FORPLOT PART: 1
SAMPLE MAP USED FOR RUN COST ESTIMATES
105° 52' 11" WEST
INCHES
105° 48' 0" WEST
39° 55' 15" NORTH
39° 50' 59" NORTH
INCHES
5000.0 = XSCALE
5000.0 = YSCALE
0.100 = XCELL
0.167 = YCELL
-1 = ACRES
3 = NOP

FIGURE 7