Pacific Southwest
Forest & Range
Experiment Station

P. O. BOX 245
BERKELEY, CALIFORNIA 94701

1968

U.S.D.A.
Forest Service
Research Note
PSW-178

Inventorying National Forest Resources...

for Planning-Programing-Budgeting System

Miles R. Hill Elliot L. Amidon

ABSTRACT: New systems for analyzing resource management problems, such as Planning-Programing-Budgeting, will require automated procedures to collect and assemble resource inventory data. A computer - oriented system called Map Information Assembly and Display System developed for this purpose was tested on a National Forest in California. It provided information on eight forest resource systems at an average cost of 0.16 cents per acre. An area the size of a National Forest appears to be the upper limit for the MIADS program.

RETRIEVAL TERMS: resource management; MIADS2; PPBS; computer applications; forest inventory data.

OXFORD: 524.6--U681.3 + 641--U681.3.

The U.S. Forest Service has underway a pilot study of the Planning-Programing-Budgeting System (PPBS) applied to a National Forest. A mathematical model has been developed for the Eldorado National Forest, in California. PPBS approaches work planning on a National Forest by evaluating results in terms of products and services and alternative methods of producing them. The outputs from PPBS are the resources made available as a result of land management practice.

An inventory of resources was essential for the study. The large volume of information required precluded hand reduction of resource data. MIADS2[1,2] was selected as the system to be used in data reduction. This alphanumeric Map Information Assembly and Display System for a larger computer takes descriptive map and associated quantitative data and makes them available for analysis and decision-making. It can record, update, assemble, and display map information rapidly and efficiently in both tabular and graphical form.

We found that MIADS2 can be used to assemble forest data up to an economic limit of about 50,000 lines of map data at an average cost of 0.16 cents per acre. An area the size of a National Forest appears to be the upper limit for the system. Hand-coding cost fluctuated tenfold between code systems of MIADS2, but averaged 0.06 cents per acre. Cost of keypunching and computation averaged 0.10 cents per acre. About twice as many lines of data could be handled at these costs by developing several computer programs to edit and manipulate map records.

Forest Service
U.S. Department of Agriculture

Basic Information

Most forest lands can produce multiple products in varying quantities --depending on the land treatment applied. Simple rules for treatment selection are no longer adequate. For example, it is not enough to say that we will reforest the best timber-growing sites first. We must also know what effects land treatment will have on the forest outputs of water, recreation, and wildlife. And we must know which treatment level will contribute most to forest goals for a given cost. What is needed is basic information about all land resources and their capability to contribute to forest outputs.

The pilot study of the Eldorado National Forest required such data from eight forest resource systems. These data, independently and in various combinations, served as inputs for the study. An automated data handling system was needed because there were literally millions of possible combinations. MIADS2, while specifically designed for such use, had not been applied on such a scale. MIADS2, then, was to provide the physical base from which forest output and changes in output would be measured. The essential "building block" used to estimate this production was acres of land, by productivity class. Since each acre may contribute multiple outputs, we needed a method that could rapidly bring together the known map data about certain physical areas.

In applying MIADS2, we needed map data at a scale of 2 inches/mile from eight code systems (80,000 records) for the six working circles on the Eldorado National Forest. Moreover, combinations were required from the more than 8 trillion possible combinations available. Such a large data base would test MIADS2 as a map information, storage, retrieval, and updating system for general use on National Forests.

Code Systems

The eight code systems supplying the input data provide the resource information now in use on the Eldorado National Forest. No special field surveys or data collection efforts were necessary. Inventory information was already on hand in the form of maps and surveys. The acreage summaries produced by MIADS2 for any individual resource system were similar to those produced by older, slower methods of data collection, such as planimetering or dot-counting on aerial photographs. The eight code systems are:

1. Timber Age and Density (53 codes): A timber survey classifies stands by size, age, and crown density. Coniferous sawtimber stands over 150 years old are further divided between uncut and partially cut stands. Hardwood and noncommercial types are also recognized.

2. Timber Type (6 codes): Compiles data from an overlay prepared at the same time as System No. 1. The six recognized classes are: Douglas-fir, ponderosa pine, mixed, sugar pine, fir, and all other.

3. Site Class and Wilderness (24 codes): Sites were classified as a part of a State-wide Soil-Vegetation survey under the direction of Pacific Southwest Station some years ago. The definitions, however, remain the same despite changes in nomenclature. The two wilderness-type areas were easily incorporated, taking advantage of the two-character capability of MIADS2.

4. Recreation (36 codes): Recreation sites--existing, potential, and reserved--as identified by the approved forest recreation plan.

5. Range and Wildlife (378 codes): The 42 range allotments are coded by nine vegetation types now used for allotment planning.

6. Elevation (110 codes): Average elevation to nearest 100 feet is interpolated from contour maps.

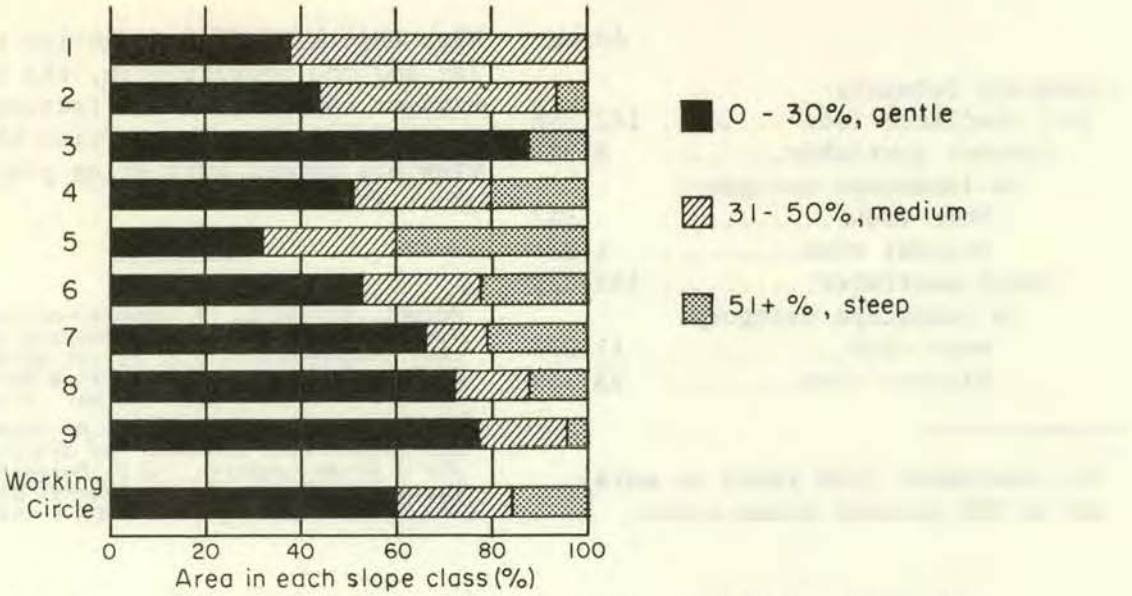

Figure 1.--*Slope classes for nine watersheds in the Georgetown Working Circle, Eldorado National Forest, California. Most of the area has gentle slopes.*

7. Slope and Watershed (216 codes): Slopes, by 10 percent classes, are measured on topographic maps for each cell within each watershed. Twenty-nine watersheds are partly or entirely inside Forest boundaries. Runoff data for 24 watersheds are available from stream gaging station records.

8. Near and Distant Views (4 codes): Two landscape categories were delineated on topographic maps during the 1967 field season. They primarily affect the timber resource. Patch cutting is not allowed in the near view. Lesser restrictions apply to the timber harvest in the distant view.

The eight code systems are not all-inclusive. Map data for other systems were excluded because they did not cover the entire Forest. Additional data can be included in the system as they become available. To match land treatments to productivity classes, detailed soil data are particularly needed.

Examples of Data Collected

Two examples will illustrate the kind of information that can be obtained by MIADS2. In the first example, information was generated by the mapping program. Code System No. 7 (Slope and Watershed) was used to collect information on slope classes for erosion-hazard rating purposes. Figure 1 shows in graphic form the wide variation in slope classes found in the nine watersheds on the Georgetown Working Circle. Since data on slopes were assembled by 10 percent classes, other divisions can be easily obtained. Once prepared, a terrain overlay can be combined with other code systems as required.

In the second example, information was generated by combining two or more code systems through the combination program. Combination of the major sawtimber types with the newly designated landscape categories can provide the forest manager with information about past cutting practices and the uncut acreage remaining in the modified class. He would find distribution of sawtimber, by landscape category, useful for planning:

	Acres
Landscape category:	
All sawtimber land[1]	142,558
Cutover sawtimber	8,723
In landscape category:	
Near view	512
Distant view	1,313
Uncut sawtimber	133,835
In landscape category:	
Near view	11,237
Distant view	23,359

[1] Old sawtimber (150 years or more), 40 to 100 percent crown cover.

With this kind of information in tabular and map overlay form, the forest manager can judge the effectiveness of past practices. In addition he can review his timber harvesting plan for the uncut stands.

FOOTNOTES

[1] Amidon, Elliot L. *A computer-oriented system for assembling and displaying land management information.* U.S. Forest Serv. Res. Paper PSW-17, Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 34 pp., illus. 1964.

[2] Amidon, Elliot L. *MIADS2...an alphanumeric map information assembly and display system for a large computer.* U.S. Forest Serv. Res. Paper PSW-38, Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 12 pp., illus. 1966.

The Authors

MILES R. HILL, a management analyst, joined the Management Sciences Staff in 1967 after a career in National Forest Administration in the Rocky Mountain Region. He earned forestry degrees at Pennsylvania State University (B. S., 1940) and Harvard University (M.F., 1948). ELLIOT L. AMIDON, an economist, is conducting forest economics studies, with particular emphasis on multiple-use problems. He earned B.S. (1954), in forest management at Colorado Agricultural and Mechanical Collage, and M.S. degrees (1960), in agricultural economics at the University of California. He has been with the Berkeley station staff since 1959.