RIDS-CURRENT TECHNOLOGY IN RESOURCE MANAGEMENT*

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Introduction

Resource managers of the Forest Service are entrusted with the stewardship of nearly 187 million acres (74,800,000 hectares) of public land throughout the United States. Most of the land is managed for multiple use--recreation, timber, grazing, watershed, wildlife, etc. Some land is devoted to a specific use--ski developments, water storage, power transmission or pipelines, etc. Other land is dedicated by law to remain in wilderness status. Decisions affecting the use of this land are difficult and the impacts on the environment are of vital interest to managers and users alike. It is incumbent on all resource managers to take advantage of as much data as possible when making these decisions. The fact that much of the terrain is mountainous and scenic further restricts the options available in the decisionmaking process. If we are to survive on this earth, we must learn to effectively manage the use of earth's resources.

Forest Service resource managers have been collecting spatial information from inventory maps and aerial photographs for many decades. Since the late 1960's,

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numerous computer mapping or Resource Information Display Systems have been developed within the Forest Service in an attempt to automate some of the most tedious tasks in the collection, data manipulation, and display processes. As a result of the developmental activities by various field units, several systems evolved that performed similar functions. To avoid further duplication of development effort, the Resource Information Display System (RIDS) has been adopted for Service-wide use. In doing this the Forest Service is assured of (1) a standard technology transfer package with user guides, (2) a Service-wide system with program documentation which is being maintained and supported, (3) a system that promotes, on a national basis, data standardization, and (4) user continuity. A Service-wide system also reduces the need for constant training and retraining of users due to changes that result from user mobility and reassignments.

This paper is a brief explanation on what the RID system is and examines the means being used by the resource managers to assist them in managing the earth's resources.

Development

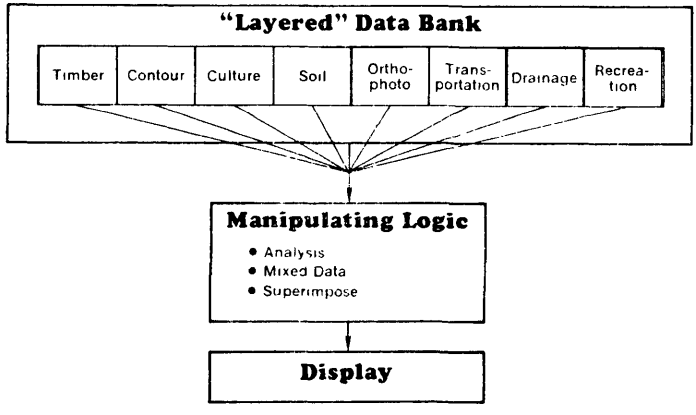
RIDS is an overlay processing system which uses the computer to derive, summarize, and display layered information digitized from maps and aerial photographs. Input to the system can be either in the form of "grid" (cell) or polygon. The system is geographically referenced, that is, cellular and polygon data are keyed to longitude and latitude. Therefore, any data that is similarily referenced can be input into RIDS.

Resource information such as vegetation types, soil classes, land forms, etc., are interpreted and delineated on maps or photos then digitized as input to the RID system. Digitized planimetric features such as political boundaries, land net, transportation facilities, etc., are also input. Slope and Aspect zones may be obtained by processing topographic data in the Topographic Analysis System (TOPAS), which is another Service-wide system. The processed data then can be used as additional layers of information in the digital data bank.

The RID system is designed to overlay various layers of data to produce responses to resource managers' requests. For example, a manager would like to know how many hectares of hardwoods there are in a certain planning unit which are in soil classes XG on slopes between 20-30 percent, outside delineated recreation areas and dedicated wilderness areas. The output from such a query would be a statistical listing of the hardwood in hectares and a graphical representation either in the form of line printer output, a cathode ray tube (CRT) image and hard copy or plotter output which could be registered to a map base.

The system utilizes the tremendous storage and manipulating capacity of advanced computer technology to generate and display the information that is required in the decisionmaking process. The Forest Service has a central high capacity UNIVAC computer system located at Fort Collins, Colorado. It serves all Forests on a time and cost-sharing basis. The data is collected and stored separately, by layers, so that it can be called upon an "as required" basis. Individual layers of information can then be overlayed and displayed as computer generated multi-layer maps.

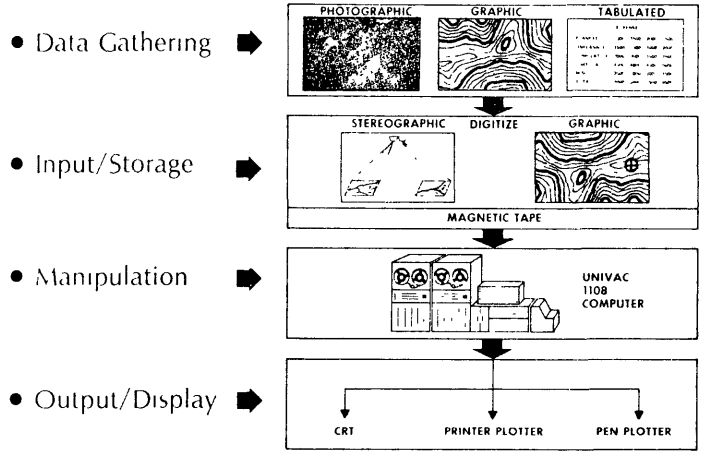
Computer Based Multi-Layer Mapping



The RID system can be divided into four basic phases. First, relevant source data is gathered, either by photographing or scanning imagery, by field tabulation, or from existing maps. This data is entered and

stored in computer memory by digitizing with either a two dimensional graphic or a three dimensional stereoscopic system. This source data is then manipulated by the UNIVAC 1108 to generate the output displays used in decisionmaking. And finally, the computer drives a variety of output devices which draws the displays.

Major Subsystems



Data Gathering

Over the years, resource specialists have been organizing data on maps and aerial photographs and cross-referencing to statistical data. Identification codes have been devised to describe the data in legends on maps. This information also can be digitized and recorded on magnetic tapes with existing tools. However, most data collection has been accomplished independently by each resource specialist. Little consideration was given to any standard, scale, accuracy, or systematic process for later combining the results of each individual's effort. Today, it is vital to collect data in each of the soil, geology, and vegetation categories in a standard, coordinated, systematic manner to avoid later duplication of effort. Data can be collected from any scale source material for input to the RID system.

Data Input

Once the relevant data has been gathered, it is then entered into the computer memory. Data can be hand coded by placing a grid over a map and identifying the data by row/column, digitized with either a two or three axis digitizer or use automated scanning techniques.

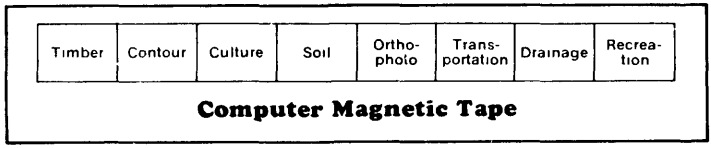
Controlled aerial photography provides the initial stereo pairs that can be photogrammetrically scanned in a systematic manner, recording spatial data (x, y, z positions) in known increments. These data are automatically recorded and stored on magnetic tape. At the Forest Service computer center in Fort Collins, Colorado, software programs convert spatial data to map products depicting slope, aspect, elevation, contours, seen areas, perspectives, and many others.

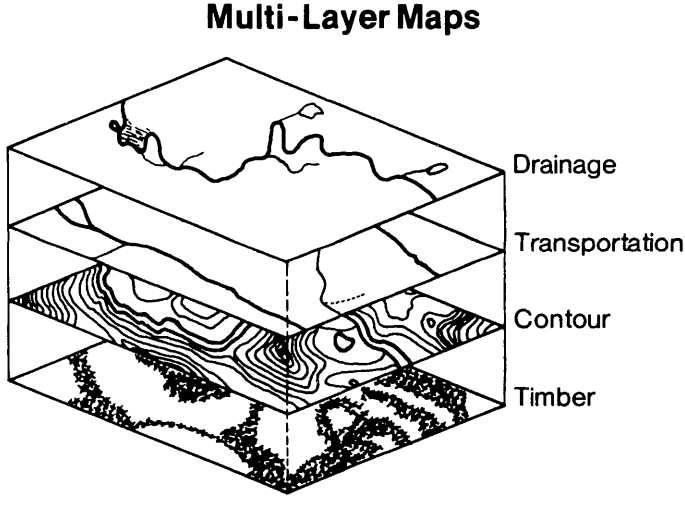
The same aerial photographs also serve as the basic tool for collecting and recording resource data (x, y positions) pertaining to soils, geology, and vegetation. Data recorded on the photos are classified by the resource specialist then transferred manually, sometimes with the aid of stereo-plotters, to base maps.

Data Storage

Each data type, whether it be terrain, drainage, soil, timber, transportation, or ownership, is stored as a separate layer in the data base. This means that the resource managers can obtain specific information on an individual resource type or overlay the data using the system to derive a composite multilayer map containing the exact information required for a specific management situation.

Data Storage

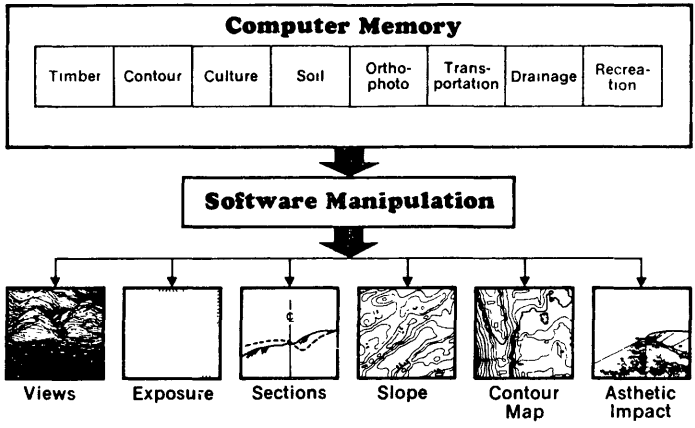




Data Manipulation

But even more importantly, RIDS software routines can manipulate this basic "layered" data and generate additional information to aid the user in decision-making. For instance, the computer can determine capability areas based on the resource managers' overlaying of selective vegetation, soils, and land forms combinations.

Data Manipulation



Output and Display

Output devices which visually display the information generated by RIDS constitute the final component of our system. Because the display requirements may vary over a considerable range, from coarse resource plots for initial planning to detailed perspective drawings for public display, several output options are available. These options present the user with wide choices in speed, accuracy, and cost. And they enable the user to tailor the output displays for specific managerial situations.

The basic display option is a low-cost printer-plot with its rapid output capability. The display is a variety of type-like symbols each having specific value or meaning associated with it. Because printer-plot displays are relatively coarse, they are most useful for displaying information where high accuracy is not important.

If a higher degree of accuracy is needed then a plot output tape can be obtained from RIDS and a plot generated on a line plotter. At present, only the Regional Offices have line plotters. Each National Forest has the capability to access the Fort Collins Computer facility and receive a line printer output.

In addition to obtaining plots, various statistical reports are available including frequency distribution, multivariate linear regression, and multiple stepwise regression. The user has the option to suppress the map outputs and obtain statistical outputs alone.

Summary

Making the right decisions for managing the earth's resources depends, to a great extent, on the correct interpretation of data which has been collected. However, knowing which data to collect to respond to critical needs may be most important. Also it is vital that the right data is available at the right time in the decisionmaking process. Consequently, accelerating the processes from collection of data to the decision point is an important step. The use of modern photogrammetric tools combined with computer assisted systems assures accurate timely information for today's resource managers.

The RID system, briefly described in this paper, is not the ultimate answer to effective decisionmaking. However, it does represent a quantum step from the way data was collected, stored and retrieved, manipulated and displayed only a few years ago. With this system, resource managers are able to explore alternatives, modeled with the computer, to an extent unknown previously. Computer generated graphic displays give the manager the opportunity to share with the public the options he must contend with in managing the resources. Hopefully, with the assistance of current technology better decisions on the use of the earth's resources can be a reality.

Bibliography

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