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GEOGRAPHIC RESOURCES ANALYSIS SUPPORT SYSTEM (GRASS)

The Problem

Land managers and training planners at Army installations face the complex tasks of (1) facilitating optimal training use of available range and maneuver areas; (2) maintaining current lands in a condition suitable for long term training use; (3) protecting valuable natural and cultural resources; and (4) accomodating secondary land uses, including forestry, grazing, hunting, and recreation. Furthermore, land management problems have become more complicated because new, more sophisticated weapons require more maneuver and training range area. To fulfill these complex land use planning and land management requirements, tools are needed to store, combine, analyze, and display multiple map elements.

The Technology

The U.S. Army Construction Engineering Research Laboratory's (USA-CERL) Geographic Resources Analysis Support System (GRASS) was developed to provide these management tools to Army environmental planners and land managers. GRASS also has many applications for Civil Works project planning and design. GRASS has many capabilities, including the handling of different representations of data:

RASTER DATA -- raster (or grid cell type) data can be used for analyzing, overlaying, and modeling areal features such as soil types or forested areas.

VECTOR DATA -- vector data can be used to represent linear features such as roads, streams or area edges and can be combined with raster data for display purposes or for analysis.

POINT DATA -- point data can be used to represent landmarks or the location of significant sites.

Other capabilities include:

IMAGERY -- the ability to display, geo-reference, compare and classify satellite and aerial photographic imagery.

MAPDEV -- the ability to input map data and print hard copies on various printers, including the ability to create output to a pen plotter that runs or emulates HPGL.

DBMS -- the ability to link to a Database Management System for help in managing data.

The GRASS system is run through the use of standardized command line input, and can be run under X-windows or Open windows. There is an internal language that allows users and programmers to create application and demonstration models and to link GRASS with other software packages. Users can input new data through digitization or the use of a scanner, with a screen pointing device, from a floppy disk, or from computer tapes. New data can also be created by selecting data elements from existing files for analysis. Outputs include statistical tables, text files, or maps that can be displayed on a color monitor or printed on several types of hard copy printers and/or plotters.

Hardware configurations vary from a table-top to rack mount machines, depending on the platform available and the needs of the users. A minimum configuration would include a display device that can display 256 simultaneous colors, a processor running UNIX or a similar operating system, at least 8 megabytes of system memory, at least 140 megabytes of disk space (300 to 600 megabytes is recommended), a dumb terminal, a line printer, graphics library, a 1/4" or 1/2" tape drive, and a mouse pointing device. Other options include a digitizer for map input, any of several color printers for hardcopy output, and modems and/or network connections to communicate with other machines.

Current GRASS workstations include Sun, Intergraph, MacIntosh II, CDC 4000 machines, PC-386's

and PC-486's, DEC, Tektronix 88K, Silicon Graphic's IRIS, Concurrent, Data General, IBM RISC and PS/2, and AT&T 3B2. Ports are underway to other machines.

Benefits/Savings

GRASS allows Army environmental planners and land managers to analyze, store, update, model, and display landscape data quickly and easily. Data files can be developed for large or small geographic regions at any scale desired within the limits of the original source documents and the storage capacity of the hardware. Analysis and display operations can be performed for an entire geographic region, or for any user-defined area within this region.

Status

Version 4.0 of GRASS was completed in July 1991 and is being distributed with source code; reference, tutorial and programmer documentation; and an extensive sample data set. GRASS has been installed at dozens of military installations and most Corps Districts and Labs. Copies are available to the general public through several distribution sites. For more information, see the publications "Acquiring GRASS Software" and the "GRASS Directory," available from the GRASS Information Center.

Besides military installation planners, GRASS users now include Corps Districts and Divisions, the USDA Soil Conversation Service, American Farmland Trust, the USDI National Park Service, NASA and many universities, commercial firms, and state and local organizations. Electronic communication between user sites can be accomplished over the Internet computer network. An Interagency Steering Committee and user group organizations in both Europe and North America have been established to guide planning and development of future system capabilities. This Interagency group publishes a periodic newsletter (GRASS CLIPPINGS) and sponsors an annual user group meeting. The Office of Grass Integration has recently been established to coordinate the integration of contributed software and the distribution of updated versions of GRASS.

Both user and programmer training workshops for GRASS are offered on a regular basis at many sites. A schedule of upcoming courses and workshops is available from the GRASS Information Center.