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THE SCHOHARIE COUNTY COOPERATIVE PROGRAM: A CASE STUDY IN APPLIED GEOGRAPHY

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In 1975 the Schoharie County (New York) Planning and Development Agency and the Department of Geography, State University College at Oneonta, New York, entered into an arrangement called the Schoharie County Coopera-tive Program. Under this, several different projects in applied geography have been undertaken by the department of geography for the planning and development agency. One major project has been the development of a county-wide computerized environmental information system. This system allows the planning and development agency to produce detailed maps covering a wide selection of environmental topics, to determine the best locations in the county for various activities based on certain defined conditions, and to analyze the location and spatial distribution of environmental data. This paper is a report on the development of this information system.

Schoharie County is a large, rural county located on the northern edge of the Catskill Region in Upper New York State. It faces the problems of high unemployment, decline in agricultural production increase in, absentee ownership of land, and demands on its water resources from the New York Metropolitan area. Many planning decisions related to these problems must be made at the county level but often these decisions are based only on empirical information tinted by emotional feelings. Factual information is either not readily available or not in a format easily interpreted. The major objective of this information system is to provide the county with a means to ascertain environmental data fast and in a format easily understood so that county officials can make informed decisions.

To support the development of this information system under the cooperative program, the planning and development agency has provided funds through the Comprehensive Employment and Training Act (CETA) for two full time positions and the geography department has furnished technical assis-tance and computer facilities. All work on this project has been done at the geography department where an office has been provided for this coopera-tive program. The facilities provided by the department have also included its computer graphics laboratory which has a 30 inch off-line Calcomp Digital Plotter and a 40" x 60" digitizer interfaced to a keypuch. The laboratory also possesses a large software library.

GEO-DATA BANK

This environmental information system consists of two major components: a geo-data bank and a computer software system designed to work in conjuc-tion with the data bank. The geo-data bank is organized to contain specific environmental data and uses a grid network to specify the geographic loca-tion of data. The data fall into four main categories: topographic, land use, cultural, and soil. These categories and the specific variables as-sociated with them have been determined on the basis of the character and the needs of the county. None of these data have been collected firsthand but have been extrapolated from secondary sources, namely maps. The topo-graphic data which consist of elevation, slope, aspect, and relative relief were acquired from the United States Geological Survey (USGS) maps at the scale of 1:24,000. Actually, only elevation data were collected from the maps. The other topographical variables were calculated from the elevation data. Land use data were taken from the land use maps prepared for the

Temporary Commission to Study the Catskills.(1) These maps are also at the scale of 1:24,000 and correspond in coverage with the USGS maps. These maps are based on data taken from 1973 aerial photographs. Only area type land use data were taken from these maps and these data strongly reflect both the natural and man-made vegetation patterns found in the county. Cultural data were acquired from the New York State Department of Transportation (DOT) updated maps of the USGS maps at the scale of 1:24,000. The most recently updated DOT maps covering the county are for the years 1968-69. Cultural data include such items as roads, cemeteries, transmission lines, and other man-made features which are relatively fixed on the landscape. Soil data have not been included yet in the geo-data bank. Under a second project for the planning and development agency new soil maps are being made from the 1969 soil survey maps done by the Soil Conservation Service.(2) These new maps will be at the scale of 1:24,000 and at the same coverage as the USGS maps. Once these new maps are completed the soil data will be extrapolated from them rather than from the original soil maps. The data maintained in this geo-data bank represent basic information needed in much of the work done by the planning and development agency. Also, because of the nature of these data, they are not likely to change rapidly; thus, the frequency at which the geo-data bank is built on a uniform grid network with the basic grid cell being 1/16 km^2 or approximately 15-1/2 acres. The location of the grid cells corresponds to the predefined Universal Transverse Mercator (UTM) geographic reference system. By employing the UTM system this geo-data bank can be incorporated into other information systems using this standard grid network such as the New York State Land Use and Natural Resources Inventory.(3) Also, by using the UTM geocode system it is possible to aggregate grid cells into larger cells such as 1/4 km^2, 1/2 km^2 , or 1 km^2. The size of the basic grid cell in this information system provides enough spatial detail in this rural area to meet most of the requirements of the planning and development agency and allows the overall system to be manageable in respect to data processing operations. To cover the county at this scale approximately 26,000 grid cells are needed. For each grid cell 152 pieces of data relating to the previously mentioned categories of topography, land use, cultural features, and soil are being collected and placed on a magnetic tape file. Each grid cell is handled as one record on the tape file and each record is organized as an array to hold the data pertaining to each cell. Consequently; it is quite easy to retrieve a certain piece of information for any grid cell. Only the correct UTM geo-codes for the grid cell and the array element number of the data are needed.

For ease of handling the geo-data bank is organized as one large rectagle with its dimensions being determined by the boundaries of the four sides of the county. The grid network extends across this rectangle to cover areas both inside and outside the county and forms a matrix of 213 rows by 185 columns. All grid cells outside the county are identified by a flag value in one of the array elements of the grid cell records. This type of organizational structure makes it possible to expand the geo-data bank to incorporate areas not in the county. In fact, topographical data are available for all grid cells in the present geo-data bank.

COMPUTER SOFTWARE

The computer software component of this information system consists of two major computer programs. The first program which is written in COBOL is designed to retrieve data fast and efficiently from the geo-data bank and to create an input data file for the second program. Since an individual file record exists for each grid cell in the geo-data bank, the number of input-output operations between the file and the working memory area of the computer ranges in the thousands. Generally computer languages which are scientifically orientated such as FORTRAN do not handle large numbers of input-output operations efficiently and fast. COBOL, a data processing language, is designed to work with large amounts of data and to manipulate data files requiring numerous input-output operations. The input data file created for the second program has only 213 records in comparison to the 39405 records needed to cover all the grid cells in the geo-data bank.

This first program also allows certain basic mathematical and conditional operations to be performed on one or more of the variables in the geo-data bank. This option allows new variables to be developed from existing variables in the data bank and greatly enhances the potential use of the data bank. The mathematical operations include addition, subtraction, division and multiplication. These operations can be performed between an outside constant and a data bank variable or between two data bank variables. Up to nine sequential mathematical operations can be handled by the program. Conditional operations are designed to allow comparisons to be made between values. These operations are expressed as "greater than", "less than", and "equal to". The program can also handle up to nine steps of conditional operations. To illustrate the use of these operations, the planning and development agency recently wanted to identify potential winter feedlots for deer. During the winter deer collect on heavily forested slopes with southern exposures in order to find food. The geo-data bank has information on slope, forest coverage, and aspect. By using conditional operations it was possible to identify all grid cells which possess all of the following conditions: slopes greater than 10 percent, forest coverage greater than 10 percent, and either southern, southeastern, or southwestern exposures.

The second computer program, written in FORTRAN, reads the output file of the first program and creates a line printer map based on the data from the file. This program has many options common to other mapping programs. It possesses a symbol package which allows a user the option to employ the standard symbol set provided by the program or to develop his own symbol set. A text package permits the user to submit as much textual material as desired. The legend package is organized to handle up to ten map categories and gives the user the option of four methods for calculating map categories. These four methods are: equal interval, arithmetic, geometric, and unequal interval. These options give the user considerable capability in respect to the decision making processes associated with the construction of a map.

On the line printer maps produced by this program, one printer character is equal to 4/5 of a grid cell or 1/20 km^2. A one to one relationship between the map's printer characters and the geo-data bank's grid cells is not feasible without major map distortion. The dimensions of a printer character are 1/8 of an inch by 1/10 of an inch which makes it an oblong rectagle versus the grid cell which is a square. To accommodate this situation each row on the map has been expanded.

FUTURE DEVELOPMENTS

Plans exist to develop additional software for the system. A program which would allow a user to examine subareas of the county would be helpful to the agency. Many studies and presentations made by the agency deal with subareas within the county. Maps and data covering the entire county are of limited help when the agency has to make such studies and presentations. Another program under consideration would allow maps to be produced on a digital plotter. Maps generated on a digital plotter are not as crude looking in appearance as line printer maps; thus, a person looking at plotter maps might find them easier to relate to than line printer maps. However, line printer maps cost less and require less computer time to construct than do digital plotter maps. This program might be used only to create maps for major presentations and final reports. In addition to this user oriented software, programs based on environmental models related to specific data in the geo-data bank are being considered. These models would produce auxiliary information for the geo-data bank. At present, models to simulate ground water and solar insolation are being explored. Ground water information is needed to assist the county in its decisions concerning the demands on its water resources and solar insolation data may help the many non-county residents who insist on constructing second homes in very remote sections of the county where electric facilities are not readily available.

Since this environmental information system is still in the developmental stage, it has not been handed over to the planning and development agency for its use yet. Some maps have been produced for the agency by the system but it is too early to draw any conclusions about the impact of the system on the planning problems and decisions faced by the agency and by county officials. However, the agency seems to be quite pleased with the results thus far provided by the system. Based on the present rate of development, the geo-data bank and the presently developed software along with documentation should be ready for the agency by next year. The actual operation of this information system will continue on the college's hardware until the agency finds adequate facilities at the county level to handle the system.

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