

GEOGRAPHIC INFORMATION SYSTEMS: ALL THAT GLITTERS IS NOT GOLD

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The title of my paper might suggest to some readers the author's disaffection with Geographic Information System (Natural Resource System) technology. I hope to demonstrate, however, that any disaffection results not from the technology itself, but from the failure of the "industry" to provide a marketing vehicle which would permit consumers to make rational purchasing decisions. In a report prepared for the USGS in 1976,¹ the IGU Commission on Geographical Data Sensing and Processing identified 285 pieces of software for spatial data handling. In the same report, an annual rate of growth in spatial data of approximately 60% was foreseen for the USGS. Although some useful models for evaluating an agency's potential use of Geographic Information System technology have been proposed (e.g., Tomlinson et al, 1976²), the foregoing figures demonstrate the difficult challenge facing program executives.

Parks Canada, an agency of the Federal Department of the Environment, is responsible for the administration and management of Canada's twenty-eight National Parks. These parks vary in geographical area from four square kilometers to 44,807 square kilometers, occupying a wide diversity of natural habitats. Visitation and visitor facilities vary from very extensive, as in the case of Auyuittuq National Park on Baffin Island, to very intensive, as in certain segments of Banff National Park. In 1969 Parks Canada initiated a program of natural resource inventory which has now spread to virtually all parks. Covering a broad spectrum of natural resource components, this inventory program

has been applied most frequently at a scale of 1:50,000. The Banff/Jasper inventory program will generate approximately 3,500,000 bits of data for 100,000 polygons spread over some forty 1:50,000 National Topographic Series maps. Many park data bases are complicated by the fact that progressively more detailed resource data are nested within a biophysical or ecological classification framework necessitating the development of up to three geographical and descriptive data bases. For an overview of this mapping program, refer to the author's article, "Resource Inventories in National Parks: An Introduction to the Methodology and Applications".³

The user community for the resulting park natural resource data base is diverse as are its component data requirements. Park planners, resource conservation and interpretation specialists, engineers and managers each draw on these data at different times and at different locations. Figure 1 demonstrates the broad relationships between a park biophysical data base and principal user groups.⁴

AN INFORMATION MATRIX FOR NATIONAL PARKS

Level of Information Required Sub-Activity or User Information	Land Region and District						Land System						Land Type					
	Systems Planning	Management Planning	Resource Conservation	Interpretation	Visitor Services	Engineering	Systems Planning	Management Planning	Resource Conservation	Interpretation	Visitor Services	Engineering	Systems Planning	Management Planning	Resource Conservation	Interpretation	Visitor Services	Engineering
Economic						●	●				●		●				●	
Cultural/Social			●	●	●											●	●	
Historical	●		●	●			●	●								●		
Archaeological							●	●	●	●						●		
Flora	●							●	●	●					●	●		
Fauna	●							●	●	●					●	●		
Limnology				●					●						●	●		
Hydrology	●		●	●				●	●							●		●
Climatology	●		●	●				●							●			
Pedology				●				●	●		●				●	●		●
Geomorphology	●							●	●	●		●			●	●		●
Geology	●	●	●	●		●					●					●		

Figure 1: Minimum Information Detail by User Groups and Discipline

Available data has a habit of generating new uses, or of subtly increasing the data demand of existing uses. This is particularly true of natural resource data uses as no question within this domain is finite. Many agencies, Parks Canada included, have been unable to come to grips with an exploding demand for natural resource data and have consequently slipped into a position of dependence on Geographic Information Systems for much of their complex data handling. New technology has crept in; Landsat imagery is an example of a new tool of resource management agencies with potentially unlimited demand for spatial data processing.

Most users of large natural resource data bases are public agencies which assess their data and data processing needs in terms of a legislated or policy mandate. The question of costs and benefits is often overlooked in preparing programs, the product of which is in the public eye. Two agencies in the United States which have recognized a potential loss of management control of the growth and relevance of their spatial data handling programs are the United States Geological Survey and the National Parks Service. The USGS commissioned the IGU Commission on Geographical Data Sensing and Processing to analyze its position and the USNPS has arranged a special session of this conference to address certain of their key concerns.

Two years ago, Parks Canada initiated a comprehensive evaluation of its internal clients for natural resource data and of the range of client demands for data processing.⁵ The ultimate objective of this evaluation, which has been much delayed but is now nearing completion, is the establishment of:

- a) A long term decision regarding the content of National Park natural resource data bases;
- b) A framework for developing a unified system of data base management; and
- c) A framework for evaluating the requirement for use of GIS technology.

The principal goal of this evaluation program is not to analyze the effectiveness of those Geographic Information Systems currently in use, nor is it to select that system best suited to our needs, but is initially to examine each client group's stated data and data processing needs. Remember, each of these needs has grown for a ten year period adjusting to technological innovation, increased access to more sophisticated data, increased staff, and increased visitation to National Parks. Throughout this period, the only measure of the effectiveness of each client group has been in terms of how well each has met their broad mandate. Only in a limited number of cases has cost effectiveness of alternate methods of

meeting a mandate been examined. The current evaluation has identified six broad client groups and twenty-three principal categories of spatial data handling.

Following a review of all data handling needs, clear specifications for the contents and structure of a park data base can be prepared. In effect, the lid will be put on the growth of data committed to such a data base. An assessment of the volume, frequency and complexity of data handling needs will be used to determine the requirement for digitizing the data base of any one park. Parks Canada is currently a user of the System 2000 data base management package, the Canada Soil Information System (CanSIS) and the Canada Geographic Information System (CGIS). The latter system, operated by the Lands Directorate, a sister agency within Environment Canada has proven out well in Terra Nova and Gros Morne National Parks, offering flexibility in data base structure, and satisfaction of most user demands. Several lesser systems have come and gone like the tides.

Bill invited me to participate in this session and to relate some of Parks Canada's experiences regarding this evaluation program. During the course of the evaluation, I have noted a series of difficulties facing agency managers which should be addressed to conference participants and which may generate some discussion in this session:

- GIS technology can represent a negative influence in the user community in that it fails to promote discipline in the identification of data and data processing needs.
- The proliferation of software and hardware has not been accompanied by the development of effective tools for assessing costs and benefits.
- No consumers group or agency objectively reports on the effective operational status of GIS software.
- No effective consideration is given to futures in the natural resources spatial data field, and in particular, to innovations which will result in new demands for storage and processing.
- The industry has failed to promote cost-packaging; variable jargon is used to describe system features and costs quoted do not reflect adequately all staff and equipment costs.

On the positive side of the equation, technological innovations in storage and computing devices have created a powerful tool for resource managers in decentralized agencies. I do not mean to play down the benefits of GIS technology, but to stress that the advantages are concentrated at the working level. Restraint in the growth of the budgets of publicly-funded agencies suggests that

evaluations similar to those undertaken by Parks Canada might become more commonplace and should become a part of the data handling decision-making process.

Summary

Technological developments in the laboratory are an essential component of any industry and are vital in the field of spatial data handling. Practical applications of this technology should not be oriented at allowing agencies to deal with unchecked growth in spatial data. Effectiveness and efficiency are key words in establishing discipline in data-demanding programs and should become the concern of the GIS industry. Agencies must curb their demand for spatial data by more rigorously monitoring the incremental growth of data bases and data processing needs.

References cited

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