# DATA TRANSFER BETWEEN GIS IN CANADA: A REVIEW OF THE PROBLEM AND EXAMPLES OF CURRENT SOLUTIONS FROM ATLANTIC CANADA

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## ABSTRACT

At the Federal level, Canada has developed standards for data transfer between various agencies. While these standards have been used in a number of pilot projects within government, the topic continues to be of considerable concern for users of digital mapping technology. In Atlantic Canada, recent work (Maher and Colville, 1985) has illustrated the technical feasibility of transfer between ARC/INFO, CARIS, and STRINGS. The three primary systems available in the region use the DLG transfer standard.

In September 1985, the Nova Scotia Land Information Committee established a working group to review the need for a regional standard. This led to a consultant report and evaluation by an expert panel. On the technical level, the Nova Scotia Land Survey Institute has developed custom software to permit transfer between the following systems: CANSIS-ARC/INFO, DIPIX-ARC/INFO, and Surveys and Mapping digital mapping format-ARC/INFO. With the acquisition of the STRINGS, Kern, and MAP software, additional transfer capabilities will be developed over the summer months.

The results of specific projects are placed within the context of a summary review of the systems, their data structures, and application in Canada. Likewise, the general conclusions relate to vendor systems which are evolving in the same direction with increasing recognition of the needs for routines which dispel the concern of incompatibility with the previous generation of GIS technology. At this time, with the increasing number of vendor products and data sources, there appears to be a large demand for custom transfer software. Until we can effect efficient transfer, then we will not address the question of data quality which will be more critical as users better understand their application.

## INTRODUCTION

There are three levels of government in Canada: Federal, Provincial, and Municipal. Each level has developed digital mapping technology to serve the objectives of their respective departments. To appreciate the potential for information exchange, Table 1 and Table 2 indicate the department/agency, nature of the geographic information system, and type of data

for the top two levels. Municipal Government in Eastern Canada is beginning to undertake studies into the potential of GIS.

Table 1: GIS in the Federal jurisdiction

| Department | System | Application |
|---|---|---|
| Agriculture Canada | CANSIS | Soil Inventory |
| Environment Canada | CLDS | Land Use |
| Statistics Canada | GIMMS; ARC/INFO | Census Mapping |
| Energy, Mines & Resources | | |
| CCRS | Intergraph; LDIAS | Image Analysis |
| Surveys & Mapping | Intergraph; DIPIX | Base Mapping |
| Canadian Forestry Service | DIPIX; ARC/INFO | Forest Inventory |
| Fisheries & Oceans | lFISH | Fisheries Habitat |

Table 2: GIS in Atlantic Canada

| Agency/Company | System | Application |
|---|---|---|
| LRIS | CARIS | Base Mapping |
| MRMS | Geobased; CARIS | Resource Mapping |
| NSLSI | ARC/INFO; Geobased; GIMMS; DIPIX | Education |
| N. B. Natural Resources | ARC/INFO | Forestry |
| Eastcan | CARIS | Property Mapping |
| Atlantic Air | CARIS | Property Mapping |
| J. D. Irving | ARC/INFO | Forestry |
| Fraser Inc. | ARC/INFO | Forestry |
| Newfoundland Department of Forestry | ARC/INFO | Forestry |

From these two tables, we can draw a number of broad conclusions:

1) within the Federal Government, there are several systems in current use for a variety of applications. This has led to the development of data exchange standards; for example, the standard data transfer format (Spatial Data Transfer Committee, 1979) and the Canadian Surveys and Mapping Standards (Canadian Council on Surveying and Mapping, 1984).

2) within Atlantic Canada, the primary application has been forestry and more recently Municipal planning. There are three vendor systems in current use:

ARC/INFO - from Environmental Systems Research Institute

CARIS - from Universal Systems Ltd.

STRINGS - from Geobased Systems Inc.

3) given Atlantic Canada represents a region within the country, we can anticipate local demand for federal data bases. This is most probable where the type of data represents a new application; e.g., the use of Area Master Files (AMF) from Statistics Canada for planning in metro Halifax-Dartmouth.

## ATLANTIC CANADA

The Nova Scotia Government recognized through its land information committee that several provincial departments would commence GIS acquisitions in the near future. To minimize the problems encountered elsewhere, a consultant report on data interchange between GIS was commissioned in the fall of 1985 (Coleman, 1986).

The first recommendation of the report was as follows:

> "After defining the functional GIS requirements and needs held in common by potential user departments, the province should benchmark a selected 'short-list' of GIS systems. Following this, a single vendor should be designated to satisfy future GIS system requirements within the Provincial Government."

This recommendation and five others, in the event that recommendation #1 could not be implemented, were presented to an expert panel in February 1986. From the panel session, there was a consensus that any requisition procedure should evaluate the data structure and analytic functions of a system against well defined user needs. At this time (April 1986), there is a further study into the types of GIS functions required by those major provincial departments who have expressed an interest in the technology.

On the technical side, the Nova Scotia Land Survey Institute last summer initiated a pilot project to investigate transfer of data between the three primary systems in the region (Maher and Colville, 1985). The study proved that, on a project basis, it was feasible to transfer data from the CARIS and the STRINGS systems into ARC/INFO using the DLG format (Allder and Elassal, 1984). From the study, it was concluded that for production work there remains outstanding concerns relating to the issues of data quality and differences in map projection systems.

## DEVELOPING STANDARDS

Transfer standards may be developed by government departments which have a mandate to provide digital information for a wide variety of users or may be driven by members of the industry who encourage users to follow the conventions available with their software. In the production of base maps for the country , there is a need to adhere to a standard such that the task can be decentralized and yet coordinated between different agencies (Allam, 1986, and Moore and Simpson, 1986).

In the Maritimes for resource mapping, it has been shown that all three major vendor systems can follow the DLG format defined by the United States Geological Survey. This format has the advantage of a straightforward, well documented ASCII file structure. However, from the pilot project (Maher and Colville, 1985), it was found that not all vendors fully implement the standard.

With the similarity of the data structures of modern GIS in the region, there exists the potential to develop a new standard. Existing data structures have the following characteristics:

arcs defined in from and to node terminology
arcs defined with left and right polygon identifiers
arcs identified which join at a node
polygons identified by a list of bounding arcs
attributes assignable to points, arcs, or polygons

If the coordinate strings are being transferred into a foreign GIS environment, then the host system must have the capability of building the topology for the coverage; likewise, if the attributes are being transferred into a foreign GIS environment, the host system must have the facility to link attributes with the spatial features.

## CUSTOMIZED TRANSFER SOFTWARE

Over the last three years, the Nova Scotia Land Survey Institute has produced software to transfer data between systems. This work has been undertaken within the cooperative project framework, where the projects are designed to provide valuable programming experiences for students who will likely be employed in the digital mapping/GIS field.

Settle (1983) developed a prototype transfer between CLDS and ARC/INFO using DLG as the intermediate format. In the same year, Colville (1983) and Rigby (1983) established transfer capabilities between the Aries and ARC/INFO system for raster

data (Maher, Colville, and Rigby, 1983). In the following year, we obtained reformatted Intergraph files of topographic data from EMR Surveys and Mapping Branch. This transfer was achieved by Melanson (1984), again utilizing DLG as the intermediate format. Hovaas (1985) created a prototype for the transfer of CANSIS coordinate data directly into the ARC/INFO system.

## FUTURE DATA TRANSFER ACTIVITIES AT NSLSI

At NSLSI, with the establishment of the diploma program in GIS, we have obtained additional systems; namely, STRINGS, GIMMS, MAP, and Kern. The installation of CARIS is expected later in the year. Between April and September, activities will include CLDS-ARC/INFO, vector transfer between DIPIX-ARC/INFO, AMF-ARC/INFO, plus further investigations into links with the new systems.

Within the private sector, new GIS users are demanding interfaces between systems; e.g., DIPIX-Intergraph, Intergraph-ARC/INFO, and AMF-ARC/INFO.

## CONCLUSION

Atlantic Canada, exemplifies the different data transfer alternatives. LRIS with its mandate for digital base mapping using the CARIS system at Summerside, P.E.I., is directly involved in the establishment of standards with the Federal Government. On an individual project basis, data has been transferred between MRMS (Geobased), LRIS (CARIS), and NSLSI (ARC/INFO) using DLG format. For those agencies which already have a large investment in digital mapping, vendors will provide direct transfer capabilities; e.g., SIF-ARC/INFO and AMF-ARC/INFO currently under development at ESRI Canada.

For educational institutes which use several GIS systems, like NSLSI, there is a service bureau role for customized transfer software. The shortcoming of the customized approach is the maintenance overhead of the transfer software when the vendor systems evolve in response to the market. Fortunately, however, data structures are becoming more similar and also government agencies are acquiring systems rather than developing their own GIS.

While the technical issues of data transfer are well understood, the management issues and user demands for data quality are in the early stages of evolution.

In Atlantic Canada, it is likely that three or four vendor systems will support the latent demand. With easy access to training facilities in the region for all these systems, it is expected that data transfer will keep up with the evolving user needs.

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