An Overview of the Canada Geographic
Information System (CGIS)
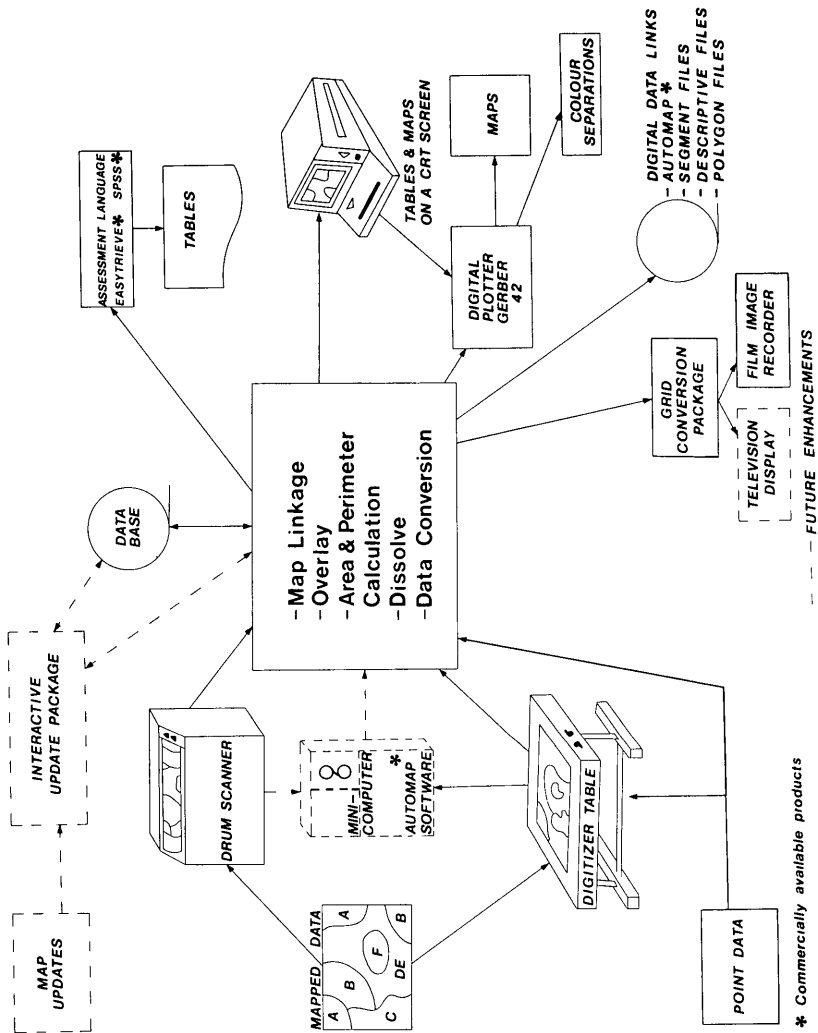
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Introduction

Planning and management of land resources
requires an extensive base of physical,
biological, social, and economic data. The
computerized Canada Geographic Information
System can efficiently handle this complex and
dynamic data base. It can store, analyse, and
present data for land use planning and
management at national, provincial, regional,
and local levels.

The Canada Land Inventory (CLI) was undertaken
in the early 1960's as a cooperative
federal-provincial effort. This program
resulted in the production of over 12,000 map
sheets pertaining to the capability of Canada's
lands to support various uses. The Canada
Geographic Information System was designed to
read, store, manipulate, and analyse thematic
map information.

At present, more than 3,500 maps have been
incorporated into CGIS data base. Although the
major data base in the system is that of the
Canada Land Inventory, CGIS effectively handles
any information which is mapped as polygons
(map units) or as points.

ASSESSMENT LANGUAGE

EASYTRIEVE* SPSS*

TABLES

TABLES & MAPS
ON A CRT SCREEN

MAPS

COLOUR
SEPARATIONS

DIGITAL DATA LINKS
– AUTOMAP*
– SEGMENT FILES
– DESCRIPTIVE FILES
– POLYGON FILES

DIGITAL
PLOTTER
GERBER
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Map Linkage
–Overlay
–Area & Perimeter
Calculation
–Dissolve
–Data Conversion

DATA
BASE

INTERACTIVE
UPDATE PACKAGE

MAP
UPDATES

DRUM SCANNER

MINI
COMPUTER

AUTOMAP*
SOFTWARE

MAPPED DATA

DIGITIZER TABLE

GRID
CONVERSION
PACKAGE

FILM IMAGE
RECORDER

TELEVISION
DISPLAY

FUTURE ENHANCEMENTS

POINT DATA

* Commercially available products

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2.0   Capabilities

2.1   Digitizing of Maps

CGIS was the first operational land data system
to use a 'scanning process' on a routine basis
for automated map digitizing. The use of a drum
scanner ensures rapidity, accuracy, low cost,
and the handling of a large number of maps. Line
following digitizing, using a digitizing table, is
also available for both polygon and point data.
All image and descriptive data is carefully edited
to ensure an error free data base.

AUTOMAP is a third method of digitizing data.
During digitizing, the data is displayed on the
computer-terminal screens providing the user
with immediate verification. The data can be
updated at any time during the digitizing
operation. Development is currently underway to
convert data from the Automap system to CGIS
format. When this interface is complete, the CGIS
will have the capability of accepting digital
image data from a number of segment oriented
systems.

The existing data base contains a wide variety of
themes including land capabilities for
Agriculture, Forestry, Recreation, Wildlife
Ungulates and Waterfowl, Land Use, Ecological
maps, Federal Land Holdings, Forest Inventory and
many more.

2.2 Management of large Geographic Data Bases

On entry into the CGIS map boundaries are removed
and the maps are divided into a number of units
called frames. Each frame can be retrieved as an
independent spatial unit. This structure greatly
facilitates the creation and manipulation of
country-wide data bases consisting of hundreds of
input documents.

The user is afforded a high degree of flexibility
in the definition of a study area; for example, he
can select geometric figures such as circles and
polygons, census boundaries, administraive
boundaries, etc. The CGIS efficiently selects and
processes only the data required to satisfy the
user request.

2.3 Data Manipulation

The unique file structure of the CGIS allows
for the efficient implementation of a wide
variety of manipulative operations. The most
significant being the polygon overlay. In a single
pass up to a 8 themes can be combined to create a
composite file containing the image and
classification information of all the intersected
polygons. This file can be used to respond to
queries such as where is the high capability
agricultural land that is currently in non
agricultural uses or to tabulate the acreage of
low capability forest land in counties X, Y and Z.

Other manipulative facilities include
reclassification of descriptive information,
dissolving of boundary information,
point-in-polygon, conversion to grid, projection
changes, area and linear measurement.

2.4   Outputs of Statistical and Map Information

2.4.1   TABULATIONS

Many types of tables can be produced. These may
include, for instance, the capability of land for
a specific use on a provincial basis, or within a
designated radius of any major urban centre in
Canada, or within any study area defined by a
user.

2.4.2   MAPS

Hard copy maps can be produced depicting a wide
variety of themes and at any defined scale. Color
maps may be produced through an interface with
color "film image recorders", or through
photo-mechanical methods.

2.4.3   DIGITAL FILES

Both tabular and map data can be prepared in
digital form for direct input into various
other data systems or into data analysis and
manipulation systems such as the Statistical
Package for Social Sciences (SPSS).

2.4.4   INTERACTIVE DATA BASES

An interactive data base is generally produced for
each special study area. This allows the user, who
is generally more familiar with his data, to query
the data himself to produce maps and tabulations.
The interactive graphics subsystem was designed
for the user with very little computer systems
background. The commands can be learned in a short
period of time, and within a period of 1 or 2 days
the average user can become reasonably proficient
in use.

3.0   DEMONSTRATED USES

The CGIS is currently being used to satisfy the
data handling requirements of large national
programs including Federal Land Management
(mapping and digitization of the boundaries of all
Federal Lands in Canada); the Canada Land Use
Monitoring program (development of sampling
methodology to effectively and efficiently monitor
land use change in Canada).

In addition the CGIS is being used to assist in
Parks Management by providing access to a large
base of ecological data and to assist in Forest
Management in Nova Scotia by providing time
series information on Spruce Budworm
defoliation and for a variety of other special
studies.

4.0   Access

Access to the system can be made anywhere a
graphics terminal is available. The Lands
Directorate currently has graphics terminals in
its Ottawa, Halifax, Quebec City, and Burlington
offices, and others are located at the Alberta
Department of Environment in Edmonton, and the
University of Manitoba in Winnipeg.

5.0   PLANNED RESEARCH AND DEVELOPMENT

A number of areas are actively being pursued
including: improved techniques for the production
of color maps, interactive color graphic output,
investigation of raster to vector conversion
algorithms and definition of standard formats for
the interchange of data between geographic
information systems.