ISSUES IN NATURAL RESOURCE SYSTEMS

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1. INTRODUCTION

There have been many changes in the methods for
utilizing natural resource data for display and
analysis. A changing perception of user needs has
interacted with an evolving and increasing awareness
of computer based technology and its potential for
handling natural resource data. In some situations
it could be said that the problem perceived has
expanded in direct or even exponential relation to a
cognisance of computer based solutions. This may be
observed when a new system enables a problem to be
viewed in a new and more useful way. The solution to
the "new" problem may be beyond the capabilities of
the system.

Of the various issues that have arisen from the
process of change, two are of particular concern.
One is the developing interest in digital
geo-referenced resource data as a source of
information, in addition to a means of producing a
hard copy representation. Another major issue is the
cost-effectiveness of digital methods in relation to
the rationalization or "backing-up" of technology to
the point of original data capture.

There are other issues and concerns in natural
resource systems. This paper examines the
"information" and "cost-effectiveness" issues from
the perspective of Systemhouse, a company engaged in
the development of integrated photogrammetric -
cartographic systems.

2.   THE INFORMATION ISSUE

Surveying and mapping agencies have traditionally
focused on the production of national and regional
maps at various scales. Recently, these agencies, in
England, Canada, the U.S., and in other countries,
have realized there are advantages to expanding their
product to include digital data. In addition to
maps, these agencies see the opportunity of having a
data bank of topographic and planimetric data
available to their clients. The idea is that in a
suitably organized digital form, the same data
that was used to produce maps can provide information
for a variety of applications.

The challenge in reaching this new data perspective
is to identify the applications, and thereby define
the necessary data organization and structures. Most
mapping agencies have introduced digital techniques
as a means to increase map production. This
objective did not require complex data structures. A
"spaghetti" approach was often taken, in which
points, lines, symbols and test were drawn to high
cartographic standards, but interrelationships among
these graphic entities were not very important.
Therein lies the rub. The information view of
geographically referenced data requires that the
geometry and topology of the graphic data be known
and integrated with descriptive attributes. These
requirements are derived from the interest and needs
of users concerned with area related data, such as
those who manage natural resources.

The task for system designers is to anticipate a
wealth of needs, and to provide open-ended systems
that are configured with micro and minicomputer
technology, all for a reasonable cost. Natural
resource systems must incorporate both information
and quality graphic production capabilities.

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3.   THE COST-EFFECTIVENESS ISSUE

The analysis and management of natural resources
generally starts with a resource inventory. The
inventory produces maps that show the distribution
and characteristics of the resources. Systems
equipped with digitizers, scanners, and
line-followers have been developed to convert the
mapped data into digital form. There has been
considerable discussion as to the cost-effectiveness
of semi-automating the cartographic production
process in this manner. The British Ordnance Survey
has estimated a 10% saving in operating budget is
achieved with improvements in production through the
use of a digitizing - editing - plotting system.
From another point of view, the Ontario Ministry of
Natural Resources has identified an approximate
threshold production cost of $400.00 per map.
Semi-automated techniques must meet or fall below
this cost as one of several implementation criteria.

Additional benefits are measured in terms of a
capability to provide a new product and service. An
increased cost-effectiveness is also anticipated from
savings realized during map revision.

Examine the resource inventory process in greater
detail. Inventories usually involve the acquisition
and interpretation of aerial photographs.
Interpretation may be performed using instruments
that range from hand held stereoviewers, to highly
accurate stereoplotters. The hard copy output from
these devices forms the basis for a preliminary map
manuscript.

The cost-effectiveness of the inventory process can
be improved by removing the need to digitize
preliminary manuscripts. In the past this has been
accomplished by retrofitting stereoplotters with
tri-axis encoders to produce digital data directly.
The use of a system that includes a modern analytical
stereoplotter as a primary data acquisition device
will further increase production rates and reduce
operating costs.

4.   THE ANALYTICAL STEREOPLOTTER

An analytical stereoplotter is an interactive device
for producing three dimensional digital data from
aerial photographs. Systemhouse has developed
the AUTOPLOT system, that includes a stereoviewer, a
microprocessor interface to a minicomputer, and
appropriate control and applications software.

The operator mounts a pair of aerial photographs on
the instrument photocarriages. Software
initialization and orientation procedures are
provided, so that transformations can be established
to accurately reference photo derived data to the
earth's surface. The operator examines the
stereomodel in the viewer, and can position a
"floating" mark by using either handwheels or a
joystick to move the carriages. A feature such as a
river or forest type boundary can be traced with the
mark and digitized.

An analytical stereoplotter such as AUTOPLOT can be
integrated as a data input device in a system
designed for the acquisition and analysis of natural
resource data. With this configuration data can be
captured directly from aerial photographs and stored
immediately with the appropriate structure and
organization in a database. Users can choose to
build either digital terrain models that represent
resources in a positionally discrete form, or, in
line segment polygonally oriented databases.

5.   CONCLUSION

AUTOPLOT has been developed as an independent
analytical stereoplotter system. Systemhouse is in
the process of producing an integrated
photogrammetric – cartographic system for the
acquisition, storage and manipulation of photo
derived data. The exciting aspect of the work is the
opportunity offered to provide a truly cost-effective
system for building a natural resource information
database, from which quality cartographic products
can be produced.

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