C   APPLICATIONS OF DIGITAL IMAGE ANALYSIS CAPABILITY IN IDAHO

Kim A. Johnson   (Director - Idaho Image Analysis Facility - Idaho
Department of Water Resources - Boise, ID)

The Department of Water Resources is responsible for administration,
planning and development of water resources in Idaho. Water is im-
portant to Idaho, as it is to all western states. Agriculture, a major
industry, is the state's largest water consumer. With 3.9 million acres
of irrigated crop, Idaho which is second only to California of the
states represented at this conference. The Department does require
accurate and timely resource information in order to meet its operational
goals. The benefits of Landsat data (potential/realized), have been
recognized by the agency.

For the last two years, the Department has been responsible for de-
veloping a digital image analysis capability for Idaho. The capability
has been established and is being used by several state/federal agencies
within Idaho. Our digital image analysis is conducted using two systems.
The major portion of our digital analysis is done using VICAR/IBIS which
was developed by the Jet Propulsion Laboratory. VICAR/IBIS is a batch
oriented software system that is installed on the State Auditor's IBM
370/168 computer. We use the International Imaging System's (I^2S) Model
70 display device and System 511 software to conduct interactive display
processing. The System 511 and display hardware is interfaced with the
Department's DEC PDP 11/34 minicomputer. The PDP 11/34 supports Remote
Job Entry to the IBM 370 and online text editing which facilitates the
assembly and submitting of VICAR jobs.

Until recently, the task of establishing an image analysis capability
has accounted for the majority of our remote sensing activities. Now
that such a capability is present, we are changing the main thrust of
our efforts from technology development to analysis applications. We
are currently addressing a variety of tasks ranging from development-
demonstration projects to rapid turn-around resource assessment projects.

An example of a development-demonstration project is the determination
of urban land use conversion in Ada and Canyon counties of Idaho. These
counties, located in southwestern Idaho, contain 27% (245,000) of the
state's population and are experiencing a 4% annual growth rate. These
counties contain 434,000 acres of irrigated cropland. Current informa-
tion indicates that the majority of urban land use expansion occurring
in these counties is involving irrigated cropland. This is not a situa-
tion unique to Idaho. The loss of agricultural land, principally to
urban land use, has been identified nationally as a topic of concern.

The land use change mapping is being done by comparing 1975 and 1980 classified Landsat data for the two counties. The 1975 data were classified by the US Geological Survey Geography Program at NASA Ames Research Center during a previous Landsat Applications Demonstration Project. The 1980 data are being classified using VICAR/IBIS. Both classifications will be registered to a map base for comparison.

Information we hope to gain from the urban change mapping include acreages of change to urban land use, location of land use change and distribution of 1980 land use. These data will support ongoing investigations which are assessing the changing water use and demand for areas of changing land use. The information will be provided to local units of government in both counties.

The Department of Water Resources is conducting a major inventory of irrigated cropland in the Upper and Central Snake River Basins of Idaho. The project, known as the Snake Plain Irrigated Agriculture Inventory, is a cooperative effort involving the Department of Water Resources, the US Geological Survey Water Resources Division and the Water & Power Resources Service. The objective of the project is to produce an irrigated cropland inventory suitable for input, in digital form, for hydrologic groundwater models and to produce an irrigated cropland digital data base for the Snake River Plain. The Geological Survey will be using the inventory results as a component in their Regional Aquifer System Assessment (RASA), project now being conducted for the Snake River Plain, and the Department of Water Resources will use the inventory data for their own modeling efforts and regional water resource planning.

The Snake River Plain Inventory is characterizied by those tasks that normally accompany a large area, 6 Landsat scenes, inventory effort including, regional stratification, ground data sampling, repairing bad Landsat data, establishing geometric control, multispectral classification and regression analysis for estimating inventory precision.

The other major task in the inventory project is the establishing of digital irrigation water source-service area data base. The data base will be used in conjunction with the Landsat classification of irrigated cropland. The various ground water models which the inventory results will be applied, require that the irrigation water source, ground water or surface water, be known. If specific surface water irrigation can be identified by diversion, where flows are measured, more precise estimates of irrigated practices and water use may be made. In order to add this dimension to the inventory data, previously existing irrigation source-service area maps showing the service areas of irrigation

districts, canal companies and areas of private (non-organized) surface
and ground-water diversions are being converted to a digital data base
using the IBIS (Image Based Information System) functions of VICAR/IBIS.
These digitized maps are based upon the US Geological Survey 1:100,000
medium scale map series. Over 300 irrigation source-service areas are
included in the data base to which Landsat analysis results will also
be registered to.

Our work in the Big Lost River Basin is an example of remote sensing
applications in its purest form. Unfortunately, remote sensing applica-
tions are often defined as a solution looking for a problem. But, in
the case of the Big Lost, a problem was presented to us and we were able
to quickly and effectively respond, fulfilling the frequent promises
we make concerning this technology.

The Big Lost River Basin is an intermountain Basin located in Southern
Idaho. The basin is approximately 2500 square miles in size and con-
taining 63,000 acres of irrigated cropland. Both surface water and
groundwater irrigation are present. Being a confined basin, there is
a significant interplay between the surface and groundwater systems.
In the recent past, there has been groundwater irrigation development
within the basin. Recently, concern was expressed by surface water
irrigators that increasing groundwater pumping was depleting the surface
water availability. The Department of Water Resources has initiated an
investigation of the Big Lost Basin Hydrologic system.

Early in the investigation, it became apparent that the amount of recent
irrigation development in the basin has to be determined. Using data
already on hand, we were able to provide a 1975 to 1980 irrigation change
determination using Landsat digital data. The area of interest was sub-
set from each Landsat scene and a Band 7/5 ratio was run for each scene.
The data was then transformed, using a simple bilinear polynomial so
that the ratioed scenes from the two dates could be coarsely registered
to each other. Both acreages estimates and a composite multidate image
was produced. We estimated that between 1975 and 1990, a total of
3800 acres of new irrigated cropland has been developed in the basin.
In addition to the acreage estimates, the multidate image was most
effective as it conveyed both the location and relative magnitude of
the irrigation expansion that occurred. The analysis work including
production of a multidate image and acreage estimates of change was
accomplished in a two person-day effort. It is this type of Landsat
analysis application that has given us the most satisfaction. We were
able to respond rapidly, with an appropriate product, to an immediate
information need.

Summary

The Landsat applications I have described, do demonstrate the activities of our Landsat/Remote Sensing Program in Idaho. This program is based upon several years of difficult work to insure that the key components were present to support such applications.

These components include a qualified and knowledgeable staff with an effective and versitile image analysis capability. Other important factors encompass the establishment of an adequate digital data and imagery library and most essentially, support from the resident agency.