B LANDSAT DEMONSTRATION/APPLICATION & GIS INTEGRATION IN SOUTH CENTRAL ALASKA

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Introduction

State and local government agencies in Southcentral Alaska, have been conducting an ASVT demonstration project with the assistance of NASA. INTRISCA, or Integrated Resource Inventory for Southcentral Alaska, has been utilizing Landsat digital data to classify land cover in 22,000 sq. miles of this area. While the primary objective of the demonstration project was classifying land cover using digital analysis techniques on the IDIMS system, training, technology transfer and preparation for an operational capability, were also considered high priorities. As such, several subprojects were undertaken that were agency specific. My comments today will address one of those subprojects - Landsat data integration into an automated geographic information system.

Demonstration Test Sites

Automated Geographic Information Systems (AGIS), were developed for two sites in Southcentral Alaska to serve as tests for both the process of integrating classified LANDSAT data into a comprehensive environmental data base and the process of using automated information in land capability/suitability analysis and environmental planning. The two sites, identified as Big Lake and Anchorage Hillside are illustrated on the following map. The Big Lake test site, located approximately 20 miles north of the City of Anchorage, comprises an area of approximately 150 square miles. The Anchorage Hillside test site, lying approximately 5 miles southeast of the central part of the city, extends over an area of some 25 square miles. Both sites evidence variations in topography, vegetation, soils and land use. The environmental resources of the Big Lake site were inventoried, mapped, automated and analyzed as part of an effort carried out under a cooperative NASA/USDA/ADNR study of the 1,600 square mile Willow Subbasin. (Figure 1)

Methodology

An Automated Geographic Information System was developed and applied toward the evaluation of land capability/suitability in the area. It had a spatial resolution of 2½ acres, areal units smaller in extent not being mapped as discrete units. The Big Lake site was windowed out of

of this data bank for purposes of the present study. A parallel data bank with the same data variables and spatial resolution was developed for the Anchorage Hillside test stie as part of the present study. As in the case of the Big Lake site, all data was mapped in a form most closely representing their natural configuration. Areal phenomena such as soil and vegetation types were mapped as polygons. Linear phenomena such as roads and streams, were mapped as lines. Small scale phenomena such as excavation sites were mapped as points. Compatible data variables were composited on the same map at the same time as rescaled boundaries were being rectified and redrawn. Four manually drafted mylar sheets, termed map manuscripts, were drawn for each area. These and the data encompassed within them are outlined below —

Map Manuscript 1	Integrated Terrain Unit Map
	Slope
	Landform Type
	General Geology
	Economic Geology
	Geologic Hazards
	Soil Type
	Land Use
	Vegetation Type
Map Manuscript 2	Surface Hydrology Map
	Stream Courses
	Watersheds
Map Manuscript 3	Point & Linear Features Map
	Natural Lines
	Escarpments
	Fault Lines
	Cultural Lines & Points
	Roads & Trails
	Extractive Sites
Map Manuscript 4	Land Status Map
	Townships
	Ownership

All of the manuscripts, except the Integrated Terrain Unit Maps, were manually delineated and subsequently automated at a scale of 1:63,360. The Integrated Terrain Unit Maps were delineated and automated at the

larger scale 1:37,000 in order to provide optimal representation of the more detailed data variables composited on them. These manuscripts were created through a process which involved spatial integration as well as compositing. In the preparation of these maps, interrelated data variables were cross compared as well as checked against the imagery and basemaps, and, where appropriate, boundary discrepancies were reconciled. The process resulted in the enhancement of the resolution, accuracy and consistency of the original data. The integrated manuscript maps, like all others, were comprised of a series of consecutively numbered units delineated on a mylar sheet registered to a basemap. These were accompanied by code sheets which expressed the attributes of each area by means of numeric codes. In addition, a coded interpretative matrix was developed and automated as a means of expanding one of the data planes in the system.

The mapped data were automated by a process of x, y coordinate digitizing. The automation procedures provided for the accurate capture of the natural form of the mapped data. The computerized data files, comprised of polygons, line segments and points, were used to create a number of plotter drawn maps of the area, as well as to create a parallel set of data files in a grid format. A uniform 1½ acre (80 meter) grid was laid atop each of the automated x, y coordinate data files for each of the sites, and the data values were transferred into and recorded by individual grid cell. Classified Landsat data were similarly formatted and merged into the grid multi-variable files for each of the sites. This additional data plane, land cover, was created through the unsupervised classification of raw Landsat digital values for 80 meter pixels and the spatial transformation and registration of these data on IDIMS. Initially compiled as grid single variable files, these data were plotted and checked for spatial accuracy and registration before being merged into the grid multi-variable files of other data for each of the sites.

Output Products

The automated data banks for each of the sites were initially used to produce a number of maps illustrating basic environmental conditions in their respective areas. Subsequently, they were used to do the following --

- Assess Environmental Opportunities & Constraints
- Evaluate Land Capability/Land Suitability
- Compare Automated Classified Landsat Land Cover Information & Photointerpreted Vegetation Units

With respect to the latter, a variety of simple discrete statistical procedures were applied to the comparison of the data for each site. Numerous computer maps were produced for the land planning efforts conducted near the Big Lake site area, fewer for the Anchorage Hillside site.

The following maps were generated for both sites —

Polygon Plot Maps 1:25,000 Scale

Land Use & Roads
Watersheds & Streams

Grid Electrostatic Maps 1:25,000 Scale

Vegetation
Land Cover (Landsat)
Geologic Hazards
Average Slope
Specific Soil Slope
Soil Drainage
Soil Limitations for Dwellings
Soil Septic Tank Limitations
Land Capability for Large Lot Residential Development

Applications

The demonstration project has two important but distinct applications. At the Big Lake site, where land cover has been previously mapped via conventional ground surveys and aerial photographic interpretation, Landsat is being tested for its accuracy in mapping relatively small areas. A successful statistical correlation between the two land cover data sets will mean that the State of Alaska could, with some projected certainty, use Landsat in an operational capacity to classify the remaining 104 million acres it is receiving under the Statehood Acts and for its stateland disposal program (Figure 2).

At the Anchorage Hillside site, another objective is planned. The Municipality of Anchorage is conducting a Hillside Wastewater Disposal Plan to identify on-site and alternative wastewater treatment and disposal techniques. The integration of land cover information derived from Landsat digital data with collateral data (soils, geology, slope, drainage, landform and land use), is being used in a GIS to produce integrated terrain unit maps and models to identify septic tanks suitability/capability. The results of this demonstration will be compared with those of a concurrent study being conducted using manual techniques.

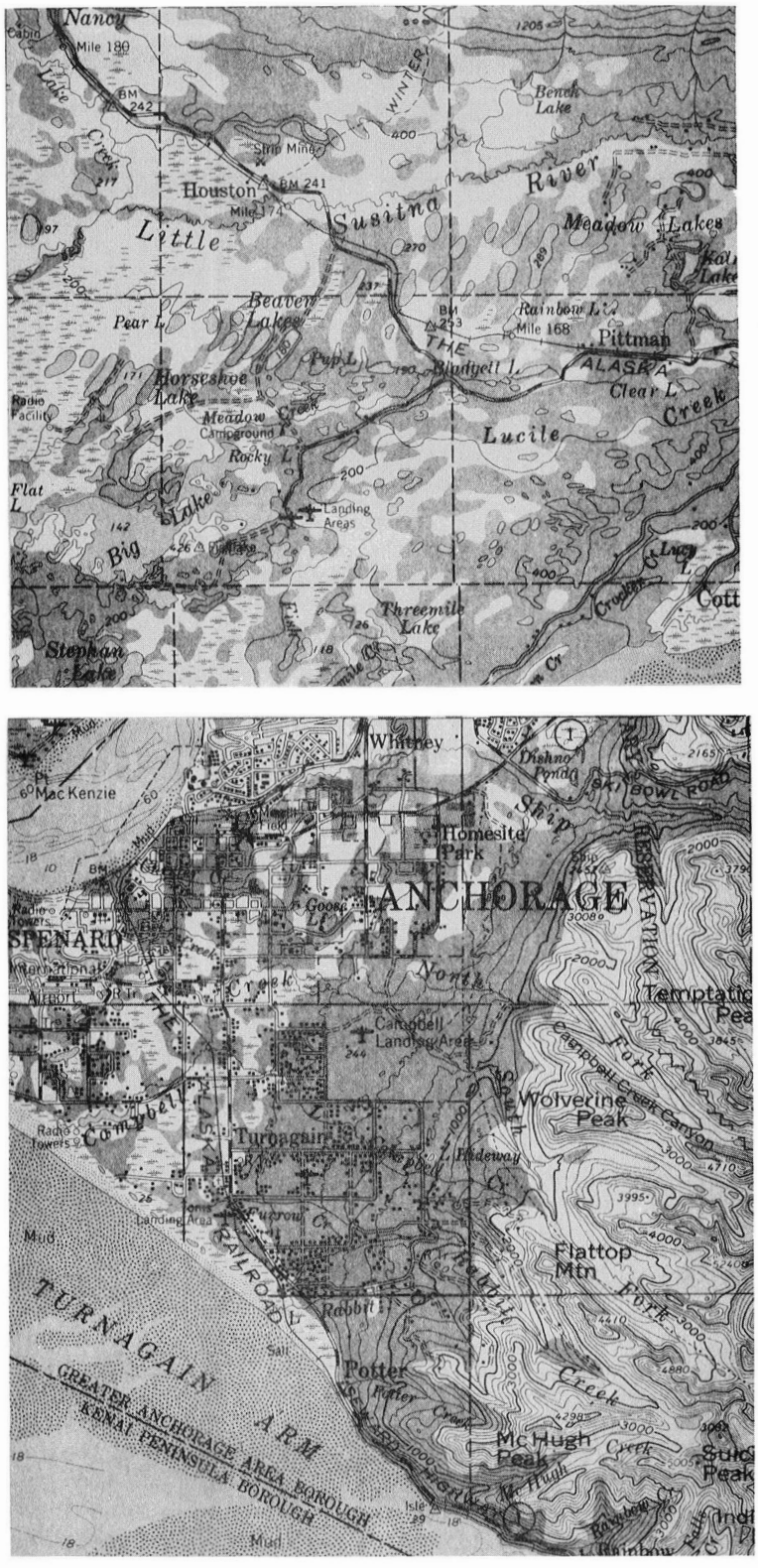

Figure 1 NASA/USDA/ADNR Study of Willow Subbasin

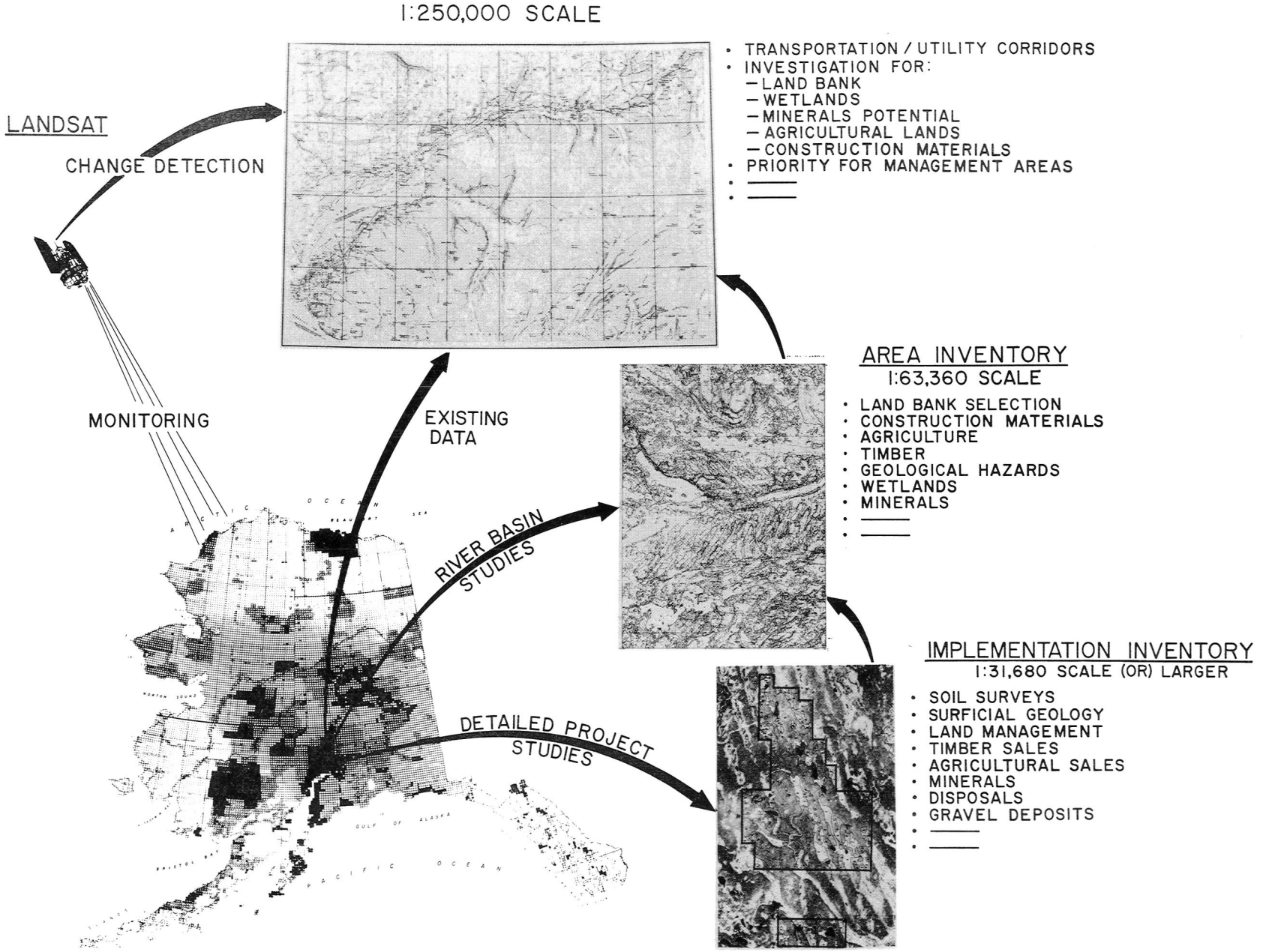

Figure 2 State Land Resource Inventory