D APPROPRIATENESS IN USING LANDSAT IN DEVELOPING ENERGY RELATED DATA BASES

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The AIS experience in creating regional data bases:

1 Impacts of activities related to energy extraction

- Coal mine reclamation and mining town location
- Oil production, interim use of extraction area without long term destruction of potential for use as agriculture, silviculture, urbanized or conservation-oriented open space.

2 Capability/suitability mapping in support of generation and substation location and transmission line routing

- Environmental issues
- Land use or cultural issues

3 Energy load forecasting based upon land use inventories and change analysis

4 Assessment of solar energy potential in a highly urbanized setting where land values are high

The Role of LANDSAT

Automated LANDSAT classification is often indicated as "The Data Source" when time constraints, budget constraints, and the large size of the study area are factors affecting the selection of data sources.

Experience shows, however, that the time for the completion of resource inventories using automated LANDSAT interpretation is often longer than required for conventional air photo interpretations for areas where both techniques have been tried.

The obvious reason is that system development and signature recognition are major efforts in an automated approach while actual mapping production may take only hours. Just the opposite is true for a manual interpretation approach.

Budget constraints are often over stressed. If one bases an estimate of the cost of conducting a mapping effort on the use of low altitude air photos , the estimated cost can be staggering; but, in the construction of regional data bases, it is medium to high altitude imagery which is most often applied. The budget for map construction in an automated mode may seem small (a few hours on a computer and then a run on a laser film recorder). The average price per single LANDSAT scene is just under $10,000 when a classified image is produced. But, when the system development and signature development work is added, this price increases considerably. Most significantly, however, is the fact that each computer run produces a map of a single parameter, while by applying Integrated Terrain Unit Mapping techniques, photo interpretation can produce a map of several parameters at the same time.

Automated classification systems require a more substantial investment in hardware, the use of more highly trained and therefore higher paid personnel, and ultimately deliver a more limited product -- hardly a help to the budget!

In many cases, the absolute size of the study area under consideration is less important than the required mapping resolution, the complexity of data classification, etc. The larger the study area, in fact, the more efficiently it can be mapped because of the normal economies of scale which effect nearly all production efforts. Using no more than 10 or 12 employees per project and averaging three to four projects at one time, AIS has mapped over 300,000,000 acres over the past five years. The same can be said for many other remote sensing firms throughout the United States.

Limitations of LANDSAT

1 Coal Mining and Petroleum Extraction

For both coal mining and petroleum extraction, manual interpretation of LANDSAT, combined with existing mapped information, serves to produce 1:250,000 scale data bases suitable as tools for making yes/no decisions for high/moderate/low rankings. These data bases are also useful for identifying the existence of potential environmental or land use issues which require further in-depth studies.

2 Capability/Suitability Mapping

Site selection for electricity production and distribution facilities requires detailed inventories of a wide variety of information. For example:

- Integrated Terrain Unit Map —

  Landform
  Surface configuration
  Slope
  Geology
  Soil
  Land Use
  Vegetation

- Administrative Units —

  Counties
  Cities
  Regional Governments
  Water Districts
  Sanitation Districts
  Air Pollution Control Districts
  Utility Districts (Electric)
  Land Ownership

- Special Physical Features —

  Earthquake Faults
  Earthquake Epicenters
  Mines
  Volcanoes and Cinder Cones
  Cliffs and Bluffs

- Infrastructure —

  Highways
  Railroads
  Airports
  Navigation Aids
  Pipelines
  Telephone Lines
  Canals and Aqueducts
  Energy Transmission Lines
  Microwave Stations

- Special Reserved Features —

  Parks
  Reservations
  Campgrounds
  Rest Areas
  Wildlife and Botanical Reserves
  Other
  California Natural Areas Coordinating Council Natural Areas

- Hydrology —

  Stream Course
  Springs and Oases
  Flood prone
  Watersheds
  Groundwater

- Climate

3 Census Tracts

Manual interpretation of LANDSAT scenes together with comparison to published data can produce some improvement in location and delineation of natural features; however, to date, no effort at automated classification of these variables has proven entirely satisfactory.

In these instances, where information must be recorded within ± a few hundred feet, pixel resolution is not adequate and data sources with better resolution must be relied upon.

4 Energy Load Forecasting

Load forecasting based upon land use inventories and change detection seems to be an area where LANDSAT data can be used in a purely automated mode. Limitations still exist in most land use classification schemes allowing discrepancies or unclassifiable categories to account for 15 to 20 percent of the area classified. In mature, urban settings, this percentage would often equal or exceed the amount of land use change which occurred.

5 Solar Energy Assessment

For solar energy assessment, one technique first tried by JPL and then adopted by AIS involved the statistical sampling of rooftop space available by land use type and then application of the resulting rooftop coefficients to the overall land use inventory of an area. This technique is, of course, subject to the same limitations as is load forecasting based upon land use inventories. It is also difficult to apply accurately using LANDSAT data alone.

Summary

AIS is a firm whose sole function is to construct geographic data bases for use in planning and analysis. To date, our experience in creating such data bases for use in energy-related efforts is that LANDSAT is adequate for general inventories where few data categories are required, where resolution of data to around 150 acres minimum is required, and where no other complete imagery set can be obtained.