OVERVIEW
National Park Service, Denver Service Center
Remote Sensing Applications Program

by
Maurice O. Nyquist, Ph.D.
Program Manager - Remote Sensing
National Park Service
Denver Service Center
P.O. Box 25287
Denver, Colorado 80225

One of the major hindrances to efficient National Park Service planning has been the lack of pertinent data. In many instances, the data are: gathered through costly contracts, out of date, inferred from secondary sources, incomplete, and, most importantly, out of sequence with the planning process. The use of remote sensing techniques to acquire certain natural resource data may circumvent this problem by providing accurate and useful data in a timely and cost-effective manner.

The Branch of Science at the Denver Service Center is involved in a program to test and demonstrate the use of various remote sensing techniques as a means of collecting basic data for planning and resources management. This program has been specifically designed to meet the following objectives:

1. To determine whether remotely sensed data using Landsat Multispectral Scanner (MSS) computer-implemented techniques, Landsat MSS manually interpreted techniques, various aerial photogrammetric techniques, or combinations of the above can provide the various types of data needed for planning and resources management.

2. To determine whether remote sensing techniques can cost-effectively provide basic information in a timeframe that is in synchrony with planning efforts.

3. To determine the utility of the gathered data for intended users.

4. To determine the feasibility of integrating remotely sensed data with other data (e.g., soils, geology, hydrology, topography, etc.) in a computerized, geographically referenced information system for planning and resources management.

To meet these objectives, six demonstration projects have been initiated in cooperation with the Earth Resources Laboratory of the National Aeronautics and Space Administration (NASA/ERL) and the Earth Resources Observation System (EROS) Data Center of the U. S. Geological Survey. These projects are being performed in four different National Park Service regions and in environments with great diversity with respect to vegetation, physiography, and other natural features. The rationale for this approach is to acquaint a broad spectrum of National Park Service personnel with the program, to more rigorously test the capabilities of the various remote sensing techniques, and to compare the results obtained using the different techniques employed by two of the leading Federal agencies which offer assistance in the field of remote sensing.

The first NASA/ERL experimental project was conducted at Big Thicket National Preserve. The objective of the project was to obtain vegetation/land cover maps using computer-implemented classification of Landsat MSS data. This project has been completed; the following are highlights of some of the more significant results.

1. Classified vegetation/land cover maps were prepared for each of the preserve units at 1:24,000 scale and for the 40 X 45-mile region at 1:125,000 scale.

2. The 36 spectrally separable classes were combined into 20 meaningful vegetation/land cover classes. These are comparable to a level II/III classification (i.e., roughly equivalent to the plant community or association level for vegetation).

3. The overall average accuracy of the classification was 85-90 percent correct.

4. The maps produced are geographically referenced to within ± 60 meters (or ± one pixel), the maximum possible resolution of the system.

5. Development of new "ground truthing" techniques and computer programs have improved the results.

6. Although there were some difficulties in data processing and field work due to the experimental nature of the project, there initially appears to be high probability for successful operational feasibility in the National Park System. However, the full utility of the data is yet to be discovered or demonstrated through day-to-day use by the park, region, and Denver Service Center during the ensuing year.

Following the successful completion of the Big Thicket Project, the NPS/DSC and NASA/ERL have entered into a more extensive technology transfer program--Applications Systems Verification and Transfer (ASVT). Landsat MSS digital data and computer-implemented classification techniques will be used for vegetation/land cover mapping at three sites--Olympic, Death Valley, and Shenandoah. In addition, at Olympic other data sources (e.g., soils, topography, geology, etc.) will be entered into a computer-based geographically referenced information system for additional data analyses.

If these projects prove to be successful in demonstrating the utility of Landsat MSS data for National Park Service planning and management, the ultimate objective will be to transfer to the NPS/DSC the in-house capability of utilizing Landsat MSS data for planning and management via an extensive training program, equipment acquisition, NASA/ERL technical assistance during initial stages of National Park Service operation, and continuing NASA/ERL assistance in terms of transferring to the NPS new or improved techniques in the area of Landsat MSS data classification and use.

Two additional remote sensing projects have been completed with the cooperation of the EROS Data Center at Lake Mead National Recreation Area and Pictured Rocks National Lakeshore. These projects were designed to coincide with General Management Planning efforts so that the information derived could be incorporated into the planning process in the proper sequence. This arrangement provided a quasi-operational testing of the techniques to determine if they can provide needed data within a practical timeframe.

The objectives for and techniques tested in these two projects are listed below.

AREA	OBJECTIVE	TECHNIQUES
Lake Mead National Recreation Area	Vegetation Mapping	1. Landsat computer-implemented classification 2. Digitally enhanced Landsat--manual interpretation 3. Small scale stereo CIR photo-interpretation 4. Medium scale stereo B&W photo-interpretation
	Geology/Soils Mapping	1. Landsat computer-implemented classification 2. Digitally enhanced Landsat--manual interpretation 3. Small scale stereo CIR photo-interpretation
	Water Resources Mapping	1. Landsat computer-implemented classification 2. Digitally enhanced Landsat--manual interpretation 3. Small scale stereo CIR photo-interpretation
	Land Use Maps of four (4) developed sites and oil/gas lease site	1. Landsat computer-implemented classification 2. Digitally enhanced Landsat--manual interpretation 3. Small scale stereo CIR photo-interpretation 4. Medium scale stereo B&W photo-interpretation
Pictured Rocks National Lakeshore	Vegetation Mapping	1. Digitally enhanced Landsat--manual interpretation 2. Medium scale stereo CIR photo-interpretation 3. Medium scale stereo BUW photo-interpretation

In addition to providing basic resource inventories and maps, the data will be used to derive additional Interpretations (e.g., wildlife habitat, carrying capacity, suitability for development, etc.) which are specifically related to the respective planning and resources management needs.

Members of the DSC-TWE planning team in cooperation with EROS Data Center personnel performed the bulk of work for the Lake Mead project. A graduate student at the Cooperative Park Studies Unit at Michigan Technological University performed the work for Pictured Rocks with assistance from members of the DSC-TMW planning team. Because training is an integral part of the EROS program, all NPS personnel directly involved with these projects received training in the remote sensing techniques employed in their respective projects.

From the experience gained through the demonstration projects, the Branch of Science is now applying some of the computer independent techniques on an operational basis. Digitally enhanced Landsat False Color Composites available through the EROS Data Center and elsewhere are being manually interpreted to provide "regional" landuse/land cover data and analyses for the new areas studies program and other planning teams. When needed, more detailed land cover/land use data is also being gathered through the use of aerial photography and field work.