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LANDSAT Remote Sensing Study of the NATIONAL PARK SERVICE BIG THICKET National Preserve



NASA

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INTRODUCTION

Proper management of national parks requires information on the type and distribution of plant communities. This information should be updated periodically to assess the effects of natural and man-induced changes. The Denver Service Center of the National Park Service, in conjunction with NASA Earth Resources Laboratory, is analyzing LANDSAT data in order to develop a cost-effective information system that will provide the National Park Service with appropriate and timely information to manage the resources under its jurisdiction. The Big Thicket study is one test case.

Big Thicket National Preserve is composed of twelve small, isolated units distributed throughout a 40x45-mile region in southeast Texas. A total area of approximately 84,000 acres is managed by the National Park Service. The diverse vegetation of the area consists of a number of major forest types representing both forested wetlands and upland forests as well as several savannah and prairie associations.



















Over the past century, the area has been subjected to extensive logging; existing plant communities are principally second or third growth. However, within Big Thicket National Preserve are pristine areas representing vestiges of the virgin natural environment.

DATA COLLECTION AND ANALYSIS

LANDSAT satellites have been collecting data over the earth's surface since 1972. The satellites are in polar, near-circular, sun-synchronous orbits with an altitude above the earth's surface of approximately 920 km (570 miles). They circle the earth every 103 minutes (14 times a day) with each successive pass displaced to the west approximately 26° of longitude due to the earth's rotation. The multispectral scanner (MSS), the primary sensor aboard LANDSAT provides a continuous image of a strip of the earth's surface 185 km (115 statute miles) wide. On the fifteenth pass, occurring 24 hours after the first pass, the coverage is shifted to the west an

amount that provides a sidelap with the previous day coverage of 14% at the equator to 100% at the poles. After 18 days, orbit 252 (on the 19th day) retraces that of the first orbit providing repetitive coverage. LANDSATS II and III, now in orbit, combine to provide repetitive 9-day coverage.

Data analyzed in this study were obtained from the MSS. The MSS measures radiance in the following wave length bands: 0.5-0.6 μ m (green), 0.6-0.7 μ m (red), 0.7-0.8 μ m and 0.8-1.1 μ m (both near infrared). Values obtained in each of these bands for each ground resolution element (pixel) form a multispectral data set which was the basis for analysis. The four radiance values for each pixel
(CONTINUED ON BACK COVER)

VEGETATION TYPE/LAND COVER CLASSES	
COLOR DESIGNATION	CLASS DESCRIPTION
	Hardwood Forest — Crown closure 70-100% evergreen hardwood understory 10% or less
	Dense Pine or Pine Plantation — Crown closure of pine 80% or greater
	Other Pine — Constitutes 40-60% of canopy; Canopy closure c.a. 60%
	Mixed pine/hardwood — Understory not defined
	Pine 10-40%/Hardwood 30-65%/Magnolia spp. 5-20%. Canopy closure 50-80% with a 50-80% evergreen hardwood understory
	Pine 5-15%/Hardwood 40-95%/Magnolia 5-30%; Canopy closure c.a. 80% with a 50-70% evergreen hardwood understory
	Pine 15-30%/Hardwood 40-80%; canopy closure c.a. 90-100%, variable understory
	Pine 30-40%/Oak 60-70%; canopy closure near 100%; mature forest with c.a. 15-20% evergreen hardwood understory
	Flatwoods Ponds — Shallow depressions which have standing water for much of the year
	Flooded Hardwood Forest — Trees stressed by presence of standing water
	Cypress/Tupelo Swamp Forest — Found most frequently in the lower bottomlands
	Pine Savannah, c.a. 20% crown closure pine, with various grasses in the understory
	Grass — Natural grasses and planted pasture grasses with few forbs
	Grass and Forbs — Often represents early old field succession
	Inert Materials of Low Reflectivity
	Inert Materials of Medium Reflectivity e.g., plowed fields, dark concrete
	Inert Materials of High Reflectivity, e.g., sand, shells, concrete, light colored soils
	Water

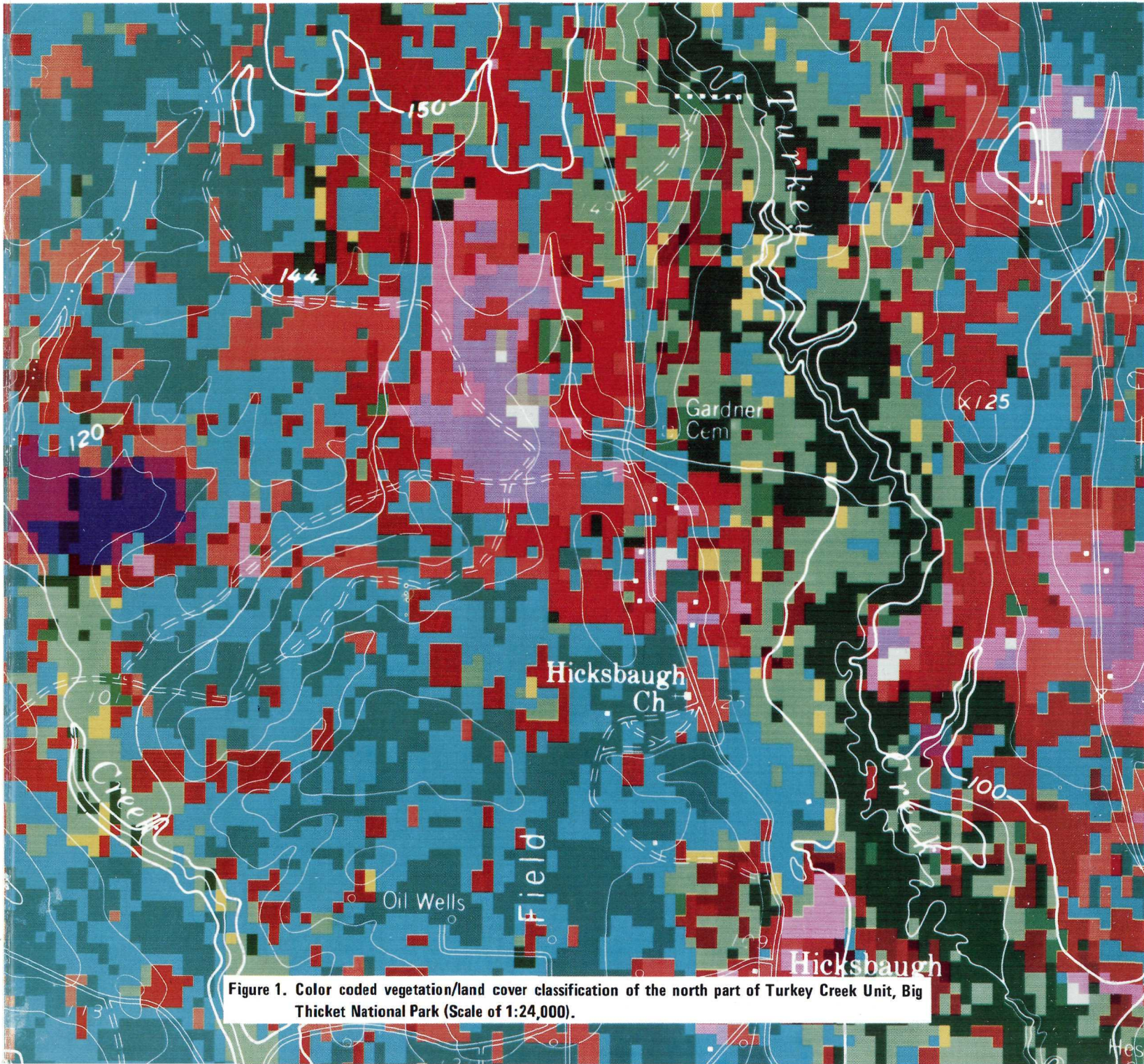






Figure 1. Color coded vegetation/land cover classification of the north part of Turkey Creek Unit, Big Thicket National Park (Scale of 1:24,000).

ORTHOPHOTOMAP SYMBOLS AND LEGEND
 <p>Ground data collection sites from I.R. positives. Dots inside indicate points digitized and identified to the computer.</p>
<p>TC-3</p> <p>Points used to register LANDSAT data to map.</p>
 <p>Random verification points with no photographic coverage.</p>
 <p>Random verification points which were photo interpreted.</p>
 <p>Verification points selected at park headquarters Beaumont, TX.</p>

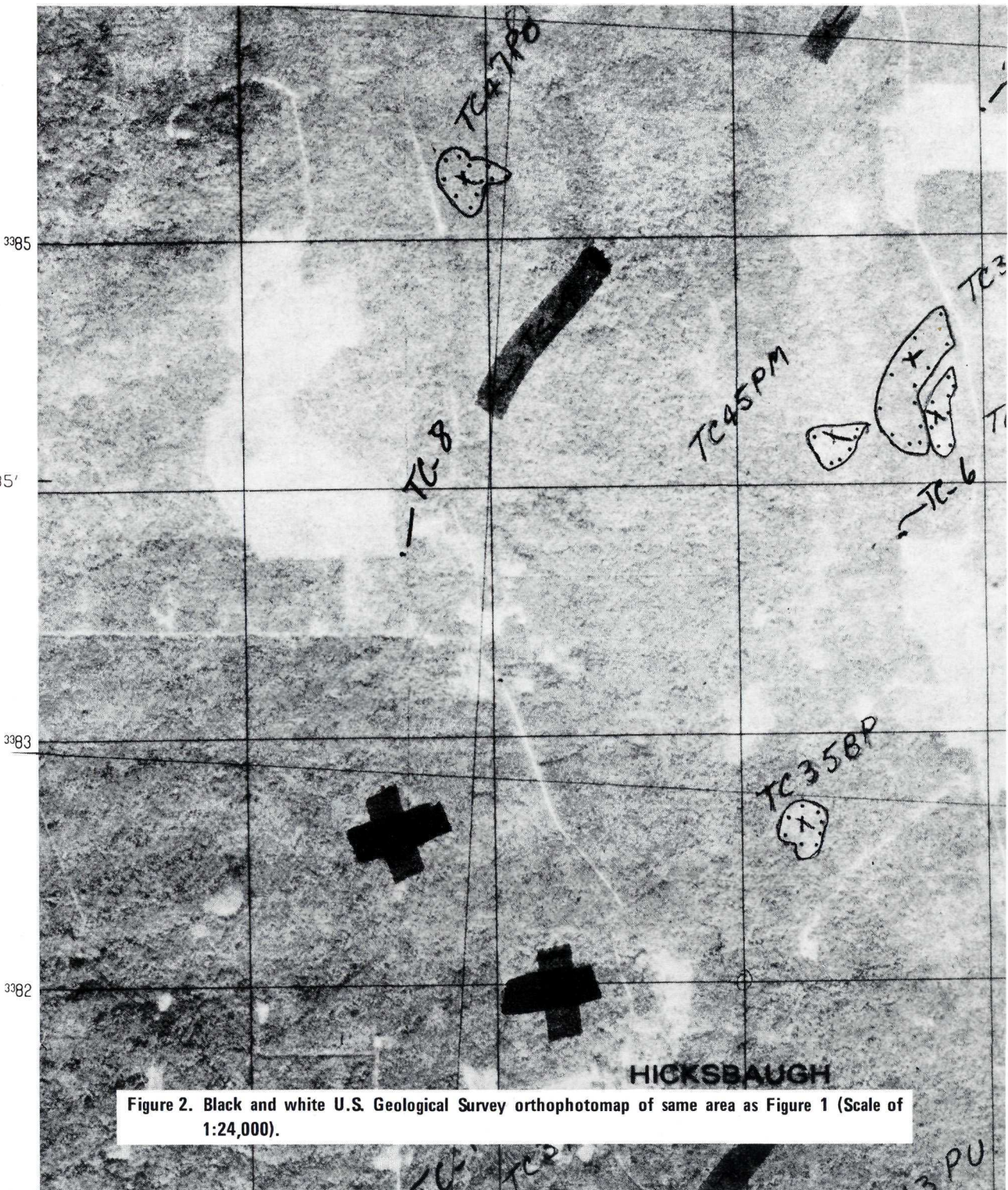


Figure 2. Black and white U.S. Geological Survey orthophotomap of same area as Figure 1 (Scale of 1:24,000).

were considered a "data vector" associated with that element. Using a digital computer each data vector was assigned to a class which contained vectors of similar character, hence a classification. This classification was based on spectral quality alone. For this particular study, two sets of LANDSAT data, February 1976 and May 1977, were analyzed and then merged to obtain the final classification of 38 spectral classes. This was done because some land cover classes which could not be identified from one data set were readily separable using the merged set. At this point, although classified spectrally, the actual ground cover of the resolution elements was not known.

On the basis of field work the 38 separate spectral classes were grouped into 18 classes associated with specific land cover. These classes were assigned colors and an image or "classification" of the area was produced to a 1:24,000 scale on color negative film. "Mylars" (transparent overlays) of U.S.G.S. 1:24,000-scale maps showing contours, drainage and cultural features were registered with the classifications and a color print was made (Figure 1). For comparison a black and white orthophotomap of the same area is included (Figure 2).

PROPOSED APPLICATIONS OF REMOTELY SENSED DATA

The primary benefits of using LANDSAT remote sensing techniques to inventory and monitor resources are derived from its synoptic view and repetitive coverage. These attributes were especially beneficial in the case of Big Thicket National Preserve.

- LANDSAT data provided an inventory of the vegetation and landcover of Big Thicket and surrounding environs at a useful level of detail and in a timely manner. This would have been difficult to duplicate with conventional ground methods because of access problems and the widely scattered location of the twelve units of Big Thicket.

Surrounding land use practices have the potential to influence the biota within Big Thicket because of the small size and isolated nature of the units. LANDSAT's repetitive coverage and synoptic view could also be used to provide data on trends in landuse practices surrounding Big Thicket, allowing compensating management practices to be initiated.

- The vegetation classification, which includes information on community composition and stand density, can be used to develop a fire management strategy and to identify sites with a potential for infestation by southern pine beetle.
- Descriptive information on understory vegetation was derived from the use of winter LANDSAT data and ground-truthing activities. This information, coupled with some additional study, may enable predictions about plant succession and potential climax communities in Big Thicket.
- The vegetation classification will provide a major input for wildlife management, since vegetation provides two of the three major components of wildlife habitat: food and cover (the third being water).
- When information such as elevation, slope, aspect, and soil types are available in a spatially referenced format they may be combined advantageously with the land cover classifications. This combined information system sometimes referred to as a "data base" has many powerful applications. For example, it may be used to locate sites for roads, trails, campgrounds, picnic areas, comfort stations, wastewater disposal areas, and other planning activities as well.

REFERENCE

W. G. Cibula and M. Nyquist, LANDSAT Study Big Thicket National Park, NASA/NSTL/ERL Report (to be published).

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35mm slide and 8x12 transparency of Figure 1 available on request.