

Developing fire histories for Southeast Region National Wildlife Refuges using LANDSAT imagery and standard protocols from the Monitoring Trends in Burn Severity (MTBS) national program.

FY 2011

PROJECT DESCRIPTION

Remote sensing of wildland fire burn intensity and spatial boundaries utilizing Landsat satellite imagery has been standardized into protocol currently used by MTBS (Monitoring Trends in Burn Severity), a multi-agency partnership between the US Geological Survey Earth Resources Observation and Science (EROS) Center and the USDA Forest Service Remote Sensing Applications Center (RSAC). Fires of greater than 500 acres dating back to 1985 have been mapped through these image processing and analysis methods for refuges within the FWS Southeast Region (R4) and are available to the refuges and other resource planners at no cost. However, at St Marks NWR for example, in a 10-year period, burned areas averages refuge-wide indicate that only approximately 20% of burned acres are from prescribed fires over this minimum threshold of 500 acres per burn. Correspondingly, while an average of 40 prescribed fires (an annual total average of 13,050 acres) have been conducted on St Marks Refuge, 31 of these fires per year (annual total average of 10,200 acres) have not been of sufficient size to be mapped and analyzed by MTBS partnership. Similar patterns are exhibited in refuges with prescribed fire management programs throughout the Southeast Region. This project provided funding for EROS MTBS analysts to evaluate fires covering the time period as early as 1985 to date. Estimates from staff at EROS indicate that image processing, mapping, and analysis costs approximately \$77 per fire when given general dates and locations of fires are available through current burn record databases (approximately 20%). The St Marks Refuge project was funded for \$25,000.

OBJECTIVES AND ALTERNATIVES

The Intra-agency Agreement developed provided DOI-FWS funding to reimburse the DOI-USGS EROS for expenditures in the analysis of refuge fire histories using Landsat imagery and MTBS standard protocols to provide spatial and temporal

information that can be used to improve management objectives in the maintenance and restoration of habitats across each refuge. The objective of this proposal was to develop parcel-specific occurrence and fire intensity histories based on 30-m Landsat Thematic Mapper (TM) 5 and Enhanced Thematic Mapper (ETM+) 7 Imagery. The resulting spatially and temporally explicit dataset will allow correlations to be made between fire history and current vegetation characteristics, particularly in reference to habitat management objectives aimed at managing and restoring optimal conditions for listed or imperiled species of the southeastern US (e.g. Red-cockaded Woodpecker, Mississippi Sandhill Crane, Florida Panther, Gopher Tortoise, Flatwoods Salamanders, and many others).

METHODS AND PROTOCOLS

This project utilized government-owned, cost-effective satellite assets: Landsats reflectance bands 1-7, (future similar projects may utilize other suitable satellite data that becomes available such as SPOT and AWiFS). Archived and current satellite imagery from MSS and TM sensors were used. The utilization of historic and future Landsat data is key for sensor calibration and image data consistency required for this long-term analysis.

Both current Landsat satellites (TM 5 & ETM+ 7) are beyond their design life, but are anticipated to last until a replacement, Landsat 8 is launched in late 2012. However, the project recognizes that alternative sensor assets may be employed in the advent of a Landsat data gap. Landsat TM 5 was the preferred data source for this project. Since May 2003, a Scan Line Corrector (SLC) failure on Landsat ETM+ 7 leaves a systematic pattern of gaps in imagery. For similar projects, Landsat ETM+ 7 scenes will be used as a last resort either singly or composited with other Landsat ETM+ 7 imagery.

Picotte, J.J., and K.M. Robertson. (2011) Validation of Remote Sensing of Burn Severity In South-Eastern US Ecosystems. *International Journal of Wildland Fire* 20, 453-464.

Eidenshink, J., B. Schwind, K. Brewer, Z. Zhu, B. Quayle, and S. Howard. (2007) A Project For Monitoring Trends In Burn Severity. Fire Ecology Special Issue 3(1): 3-21.

<http://www.mtbs.gov/scientificreferences.html>

DATA MANAGEMENT

Final products were produced and distributed by USGS EROS staff to Regional Fire Ecologist Sue Wilder and St. Marks NWR staff including the District 4 Fire Management Officer, Greg Titus. Data is stored on the North Florida Refuge Complex fire server (\\ifw4fo-flstmfir).

DATA ANALYSIS / MODELS

Data products:

- 30m-resolution map showing dNBR burn severity classes or 60m dNDVI for MSS data
- Fire perimeter based on 30m satellite imagery or 60m dNDVI for MSS data
- Pre and post fire satellite image subsets
- DNBR, RdNBR, image subsets for TM-based assessments
- DNDVI, RdNDVI image subsets for MSS-based assessments
- Metadata for the above geospatial data layers
- Tabular data summarizing acres burned by severity classes
- Tabular data summarizing acres burned by severity classes and vegetation cover types
- Tabular data summarizing acres burned by severity classes

ACCOMPLISHMENTS AND MANGEMENT IMPLICATIONS

Monitoring Trends in Burn Severity (MTBS) will investigate and determine the minimum size prescribed burns that can be reliably mapped in eastern vegetation communities using Landsat, based in part on results from this project. This information is important as MTBS endeavors to support the fire assessment and monitoring community into the future.

Using verified ground information MTBS, will test an automated method of determining the presence/absence of fire scars using NOAA Hazard Mapping System, MODIS Fire Detect data.

Feedback received from Southeast National Wildlife Refuges (NWRs) about the post fire burn severity conditions will inform MTBS analysts how to better interpret and map fire severity in similar vegetation communities.

Refuges participating in similar projects will receive a burn severity assessment of all prescribed burns and wildfires within the refuge dating as early as 1984 to 2011. This information will help Southeast NWRs determine the appropriate prescribed fire burn severity needed to promote the population growth of threatened and endangered species (e.g. gopher tortoises and red cockaded wood peckers and others). This information can help Southeast Region NWRs evaluate the relationship between prescribed fire burn severity and ecosystem health.

PARTNERS

USGS Earth Resources Observation and Science (EROS) Center; Sioux Falls, SD 57198

SOURCES OF SUPPORT

Funded exclusively through USFWS

MORE INFORMATION

Maps depicting simple fire return interval at St. Marks National Wildlife Refuge using data products from this project may be accessed by DOI employees at:

https://docs.google.com/a/fws.gov/file/d/0B_h_3BOQZm-HUU9CVElhSkh1YU0/edit

https://docs.google.com/a/fws.gov/file/d/0B_h_3BOQZm-HTkMtLTV3WWZHUDO/edit

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