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USDOI Office of Surface Mining Reclamation and Enforcement

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# EVALUATING INDIANA BAT (MYOTIS SODALIS) HABITAT CONDITIONS ON SURFACE COAL MINE SITES USING REMOTE SENSING TECHNOLOGIES: PILOT STUDY.

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## Project Description and Objectives:

This pilot study evaluated the feasibility of using remote sensing (RS) technology in developing a habitat assessment protocol for the endangered Indiana bat (IB). The general area of interest for this study included potential IB summer roosting habitats located within the coalfield region of southwestern Indiana. The specific objectives of this pilot study included:

1) Obtaining imagery from a variety of RS sources from the study area and from known IB summer habitats.
2) Testing the utility of these RS technologies to inventory and assess the quality of actual and potential IB summer habitat and monitoring protocol.
3) Developing a method to better analyze IB summer habitat quality, this in turn, could promote the development of a "habitat suitability index."

## Applicability to Mining and Reclamation:

The ultimate goal of a larger scale effort is to develop a suitability index, using RS technologies, to both inventory and evaluate, habitat features suitable for the IB on reclaimed mine sites. Once developed, the partners hope regulatory agencies responsible for implementation of SMCRA and the Endangered Species Act can use this geospatial application as a tool in evaluating how coal mining and forest reclamation affect IB ecology. Results from this phase of the study helped refine the long term goals of the study by recognizing what IB habitat elements can be identified from various types of imagery.

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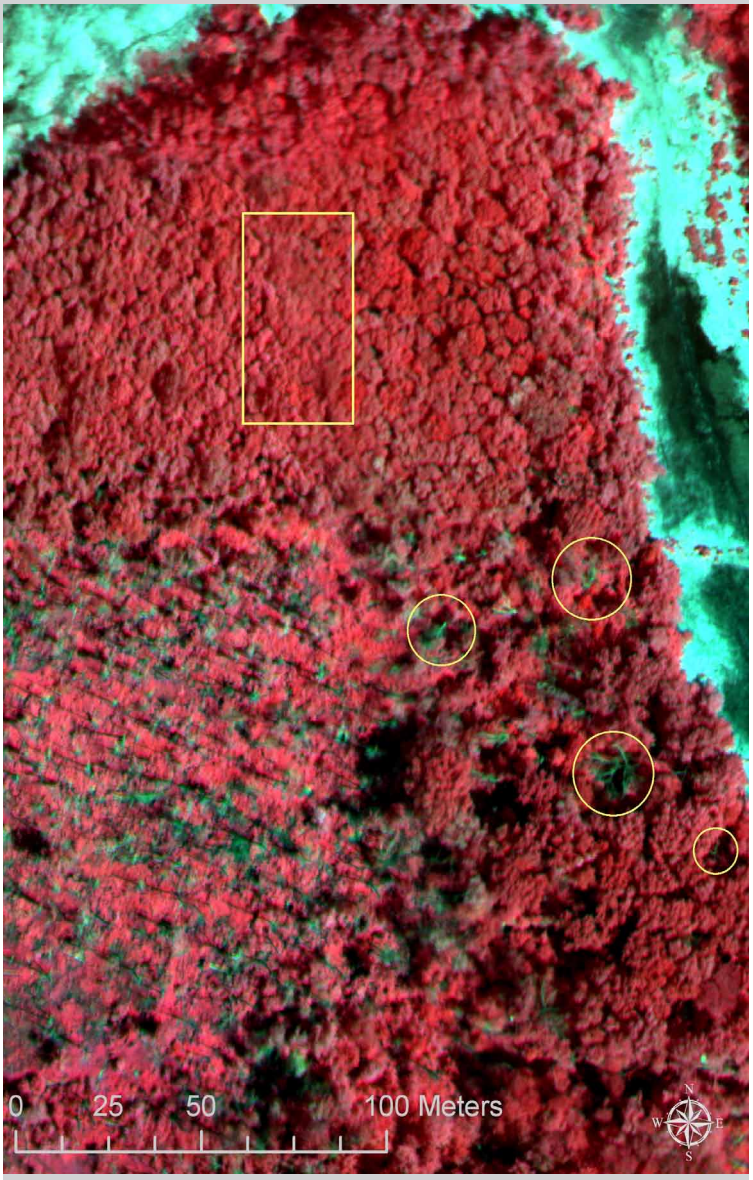


ABOVE PHOTO: Subset of high resolution digital aerial photography showing individual snags within a forest canopy, yellow circles, and a younger age class forest without visibile snags, yellow rectangle.

## Methodology:

Landsat Thematic Mapper (LSTM), SPOT 4, and QuickBird (QB) satellite images were tested for landscape level analysis. Image processing software (ERDAS Imagine 9.1) was used to conduct a landscape classification of the study area, focusing on the general types of land cover and their relative percentages for each study area. Also visual surveys of the imagery were conducted to identify features as patchiness, forest cover and structure, etc., in an attempt to identify areas with the highest potential for IB summer habitat.

High resolution digital aerial imagery (over the northern two study areas) was used in part to assess how accurate the landscape classifications had been from the LSTM, SPOT 4, and QB imagery. However, the primary focus here was on the local (microhabitat) characteristics that are seen as significant indicators of IB summer habitat quality: i.e., edge characteristics and the identification of snags, snag location, and overall snag potential.

Probable locations identified from the RS data were compared to known IB roosting sites provided by U.S. Fish and Wildlife Service.

## Highlights:

With regards to IB summer habitat, LSTM, SPOT 4, and QB provided data for mapping general land cover and land use characteristics (e.g., agricultural use vs. forest cover vs. wetlands), which would be most valuable in eliminating areas with low bat habitat potential (e.g., urban and agricultural areas). However, only the high resolution imagery provided accurate means of identifying snag locations. In some cases, high resolution imagery was capable of rating forest characteristics such as cover, tree density, stand maturity, and tree species.

## Results/Findings:

Of the currently existing RS technologies, high resolution digital aerial imagery has the highest probability of identifying the microhabitat characteristic seen as critical to IB summer habitat. However, this type of imagery is by far the most expensive, and given the amount of data collected, can only reasonably be used on small survey areas.

The high resolution photographic imagery was not able to clearly detect snags from the known roost sites, indicating that snags with a high percentage of attached but exfoliating bark and living roosts trees are indistinguishable. Many of the snags detected by the photography appear to be larger diameter and older snags, snags that typically have little remaining bark and bleached exterior surfaces. The high resolution aerial photography images can only be analyzed visually and the survey areas effectively covered by this method are small. Creating large scale surveys will be both time consuming and prohibitively costly.

Future studies may include multi-temporal approaches (within the same year or between two different years) to satellite data acquisition as an effort to increase accurate separation of land cover, expansion of the study area, a more specific aerial image acquisition process to only capture data over forested areas, and ground surveys to test the results obtained from RS data analyses.

Above Photo: Indiana Bat (Myotis sodalis). Photo Credit: USFWS

**Website Information:**

The final project report can be found at **http://www.techtransfer.osmre.gov/NTTMainSite/appliedscience/2008appscience/CompletedProjects/SIUBatHabitatBLoges08FR.pdf**


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