# APPLYING REMOTE SENSING AND GIS TECHNIQUES IN SOLVING RURAL COUNTY INFORMATION NEEDS*

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**Introduction.** This project was designed to acquaint county government officials and their clientele with remote sensing and geographic information system (GIS) products that contain information about land conditions and land use. The specific project objectives are:

1) to investigate the feasibility of using remotely sensed data to identify and quantify specific land cover categories and conditions for purposes of tax assessment, cropland area measurements and land use evaluation,
2) to evaluate the use of remotely sensed data to assess soil resources and conditions which affect productivity and
3) to investigate the use of satellite remote sensing data as an aid in assessing soil management practices.

Miami County, Indiana was chosen as the experimental site for this project (Figure 1). The Miami County Extension Agent, Jack Hart expressed an interest in using remote sensing and GIS products in his work. He arranged for other county officials to visit with LARS researchers and a proposal was developed and funded by the National Aeronautics and Space Administration. Other participants of their project are:

Greg Deeds, Miami County Office of the Surveyor,
Betty I. Craig, CED, Miami County ASCS Office,
Randall J. Moore, District Conservationist, Miami County Soil Conservation Service
Nancy Hardwick, Miami County Tax Assessor

**Approach.** Twenty-Eight square miles were selected randomly for development and evaluation of the satellite data analysis and the geographic information system. Fourteen out of the twenty-eight

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square miles are used in developing the analysis methodologies; the remaining fourteen sections are used to evaluate the land cover/land use classifications. Landsat and SPOT satellite data from 1987 and 1988 growing seasons were selected and land cover maps were classified from this data (Figure 2). Land ownership maps were obtained from the County Surveyor's Office and soil maps from the published Maimi County Soil Survey. The soil maps needed to be registered to the 7.5 minute topographic maps since uncontrolled photography was used as a base map. Both ownership and soil maps were digitized for the selected sections. Figure 3 shows the map information digitized for all sample sections.

**Preliminary Results.** The GIS approach used in this research is shown in Figure 4. The model takes into account temporal land cover information derived from satellite data through digital analysis, land ownership maps redrafted on a scale of 1:24,000, soil maps (originally published at a scale of 1:20,000) adjusted and redrafted at 1:24,000 scale, roads derived from USGS 7.5 minute quads, and drainage networks derived from the combination of USGS maps, aerial photography and soil maps. These maps are stored in the spatial database on a section basis. We have also designed two non-spatial databases (land ownership and soils) to store attribute data related to the maps. This is the subject of other paper being written by the authors.

With both, the spatial (maps) and attribute databases in place, it is possible to perform different kinds of analysis. Proximity analysis were used to calculate easements and right-of-ways for ditches and roads. Ownership, soils and land cover maps are combined using standard GIS functions to produce a final map that shows these three variables plus easements (Figure 5). Maps can be produced for a section, a farm, or the entire county if requested. Area calculations are done automatically by the system and the results are included in the tax form, along with information store in the attribute databases.

**Future development.** For the land cover/land use research, we will complete the analyses of all of the TM and SPOT data for all development and evaluation sites to assess differences due to soil and topography. Temporal analysis, to improve discrimination of land cover categories, will also be completed. Products of land cover/land use analyses, display of landownership information, soils database information and similar data will be shared with county officials, as well as the State offices of the Soil Conservation Service and the Agricultural Stabilization and Conservation Service. Actual use of the products will be monitored by the County Extension Agent who serves as a local liaison for the projects.

For the research on soil spectral properties and soil erosion potential, we will complete the laboratory analyses of additional soil samples. These results will be combined with the satellite data and used to predict soil erosion areas within the county.

As for the soil management research, we will further analyze the favorable results received to date concerning recognition of soils covered with crop residues. Models to predict erosion and phosphorous yield deposition will be developed and run. The correct discrimination among residue cover types is of primary importance to the success of these models. The ability to recognize different types of residue on the soil surface with Landsat TM data would greatly advance our abilities to assess soil erosion losses. The Miami County Soil and Water Conservation District and the Conservation Technology Information Center are especially interested in this information.

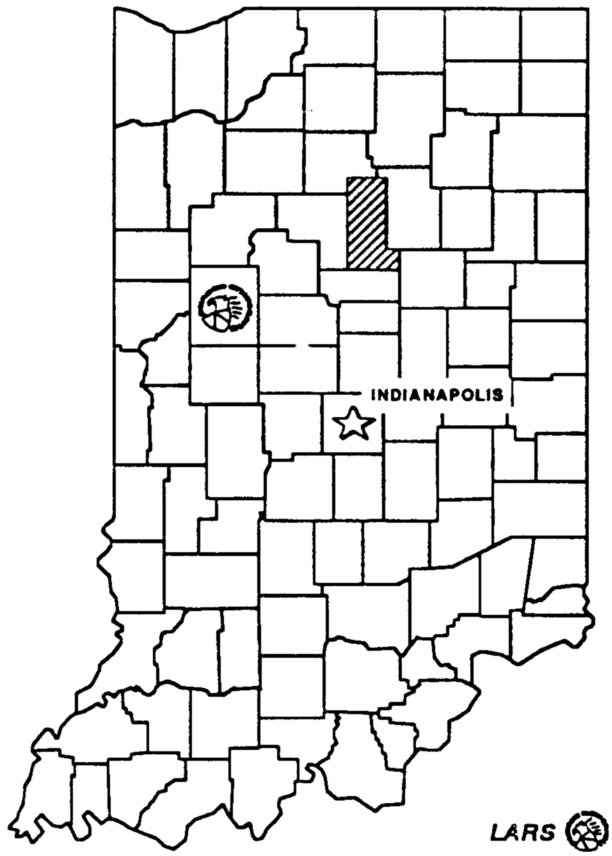
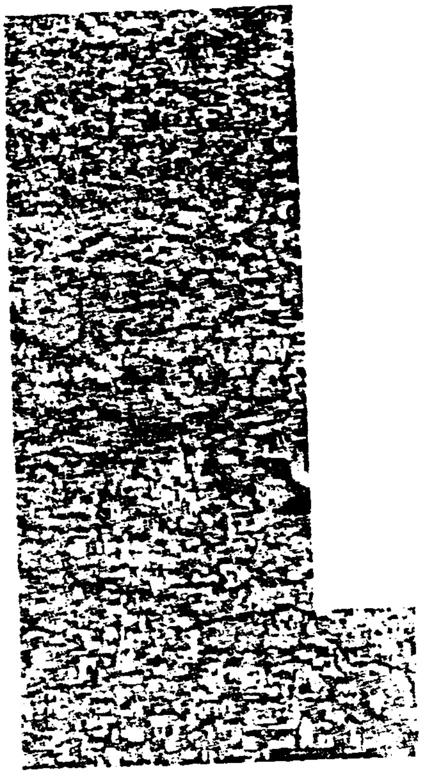
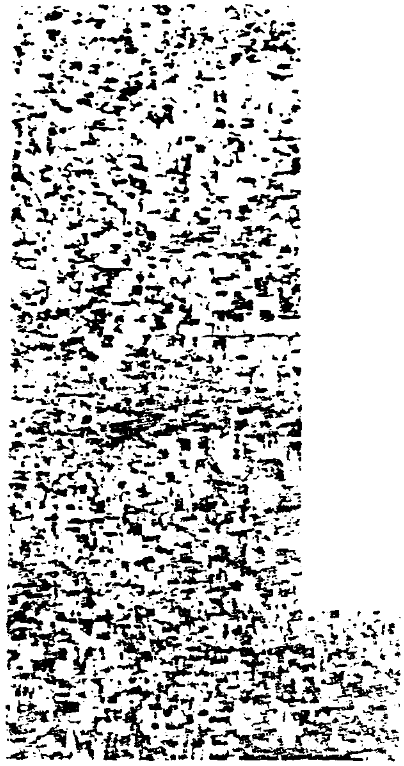



Figure 1. State map of Indiana showing location of Miami County.



Landsat-TM data (April 26, 1988),
TM-4=Red, TM-5=Green, TM3=Blue



Landsat-TM data (April 26, 1988),
Classification

Figure 2. Raw Landsat TM data map and a classification map for Miami County, April 26, 1988. Soil patterns are shown as low, medium and high contrasts and compare favorably with the soil maps of the county.

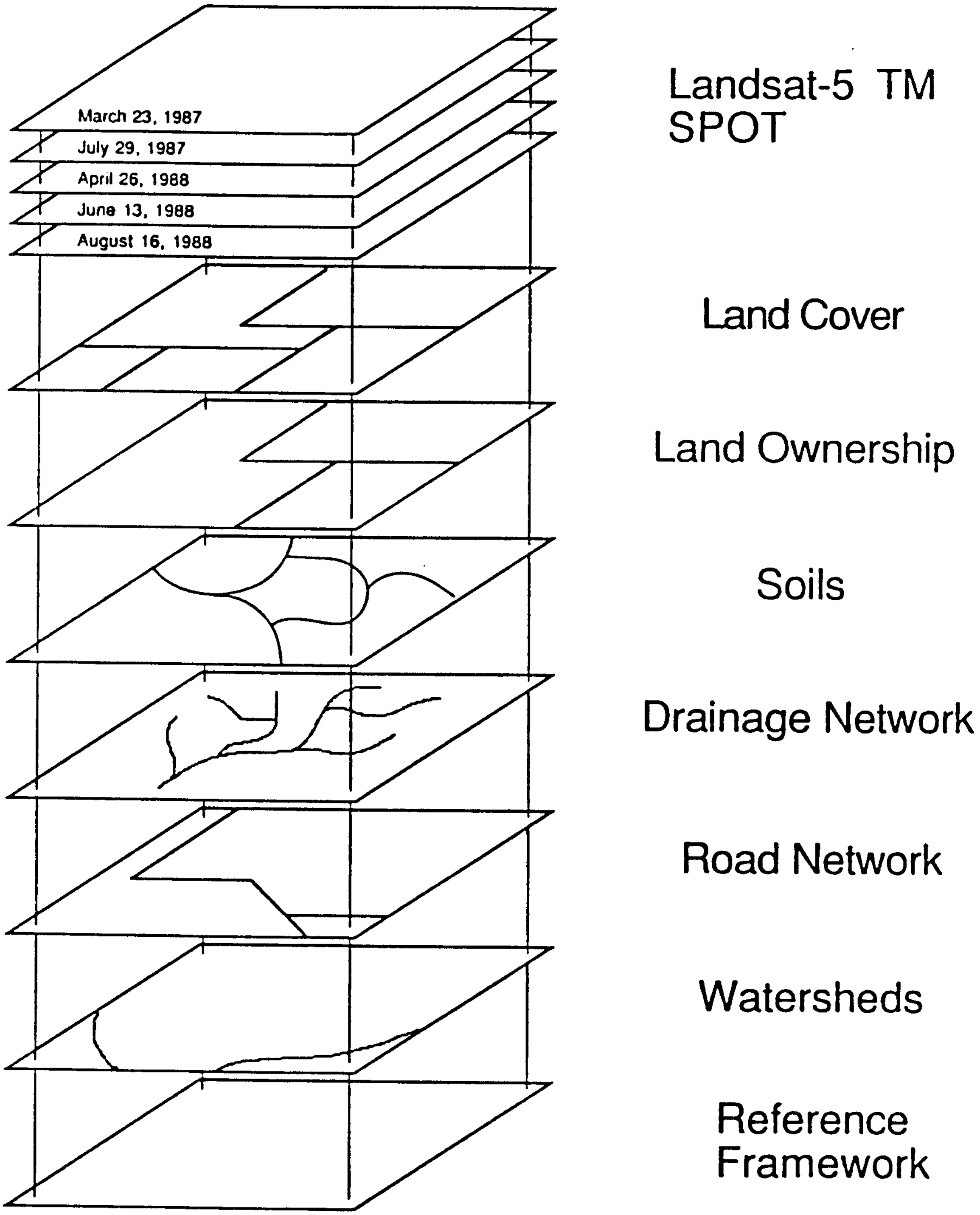



Figure 3. Representation of the spatial database of the geographic information system used in this study.

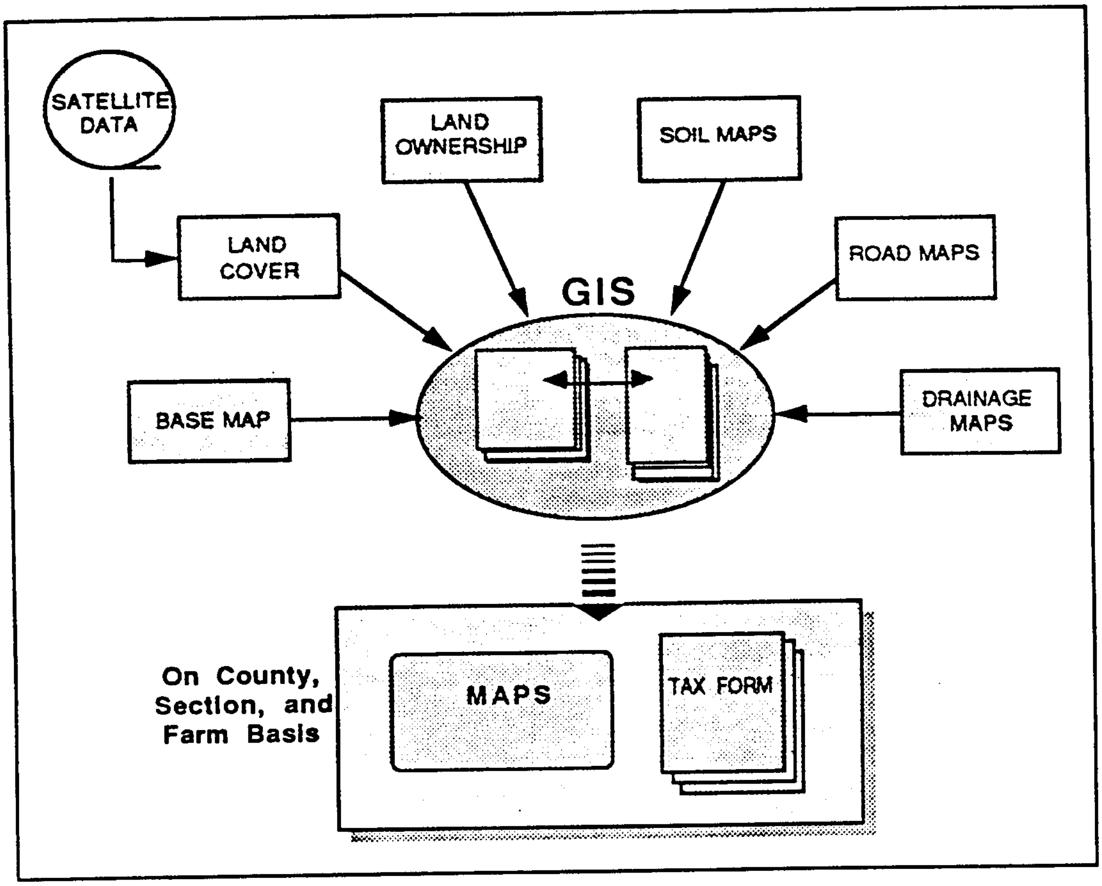
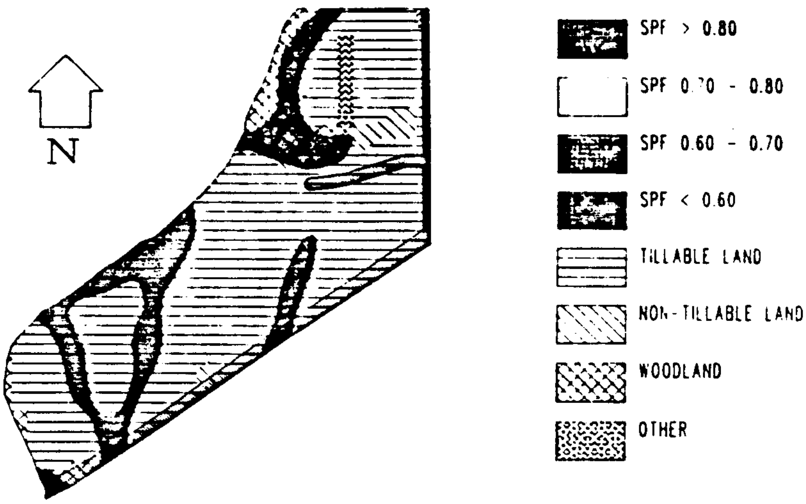



Figure 4. The geographic information system approach used in this study for agricultural reassessment.

## SOIL PRODUCTIVITY AND LAND COVER

OWNER: John Farmer

LOCATION: Parcel 6 Sect 9,T28N,R5E




LAND DATA AND COMPUTATIONS

| LAND TYPE | SOIL ID | MEASURED ACREAGE | PROD FACTOR | BASE RATE | ADJUST. RATE | EXTENDED VALUE | INFLUENCE FACTOR | TRUE TAX VALUE |
|---|---|---|---|---|---|---|---|---|
| 1 | Cr | 3.94 | 1.02 | 495 | 504 | 1,985 | 0.00 | 1,785 |
| 1 | FsA | 2.99 | 0.77 | 495 | 381 | 1,139 | 0.00 | 1,139 |
| 7 | FsA | 0.12 | 0.77 | 495 | 381 | 45 | 0.00 | 45 |
| 1 | MsB | 15.67 | 0.81 | 495 | 400 | 6,268 | 0.00 | 6,268 |
| 7 | MsB | 0.00 | 0.81 | 495 | 400 | 0 | 0.00 | 0 |
| 1 | MtC3 | 20.08 | 0.60 | 495 | 297 | 5,963 | 0.00 | 5,963 |
| 2 | MtC3 | 1.57 | 0.60 | 495 | 297 | 466 | 0.60 | 186 |
| 7 | MtC3 | 0.11 | 0.60 | 495 | 297 | 32 | 0.00 | 32 |
| 1 | MtD3 | 4.90 | 0.50 | 495 | 247 | 1,210 | 0.00 | 1,210 |
| 1 | Pw | 2.18 | 1.11 | 495 | 549 | 1,196 | 0.00 | 1,196 |
| 1 | Sh | 4.78 | 1.11 | 495 | 549 | 2,624 | 0.00 | 2,624 |
| 2 | Sh | 2.06 | 1.11 | 495 | 549 | 1,130 | 0.60 | 451 |
| 7 | Sh | 0.34 | 1.11 | 495 | 549 | 186 | 0.00 | 186 |
| 9 | | 1.00 | | 3500 | | 3,500 | | 3,500 |

MEASURED ACREAGE 61.0 TRUE TAX VALUE 22,200

| | | |
|---|---|---|
| PARCEL ACREAGE : | 60.00 | |
| 81 LEGAL DRAIN : | 0.00 | |
| 82 PUBLIC ROADS: | 0.85 | |
| 9 HOME SITES : | 1.00 | |
| TOTAL ACRES FARMLAND => | | 58.15 |
| TRUE TAX VALUE | 22,200 | |
| MEASURED ACREAGE: | 61.0 | |
| AVERAGE TRUE TAX VALUE/ACREAGE: | | 363 |
| TRUE TAX VALUE OF FARMLAND: | | 21,108 |

**Figure 5. Map of one ownership showing information of soil productivity, land cover (as determined from satellite data) and easements.**