ESRI Users Conference 2003

Using GIS to Determine Critical Forest Areas for Protection

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Using GIS to Determine Critical Forest Areas for Protection

The Project

- A study of forest canopy identification, change, and evaluation over a 17-year period.
- Project identifies and prioritizes critical forest areas based on an index of urban/rural benefits, and projects expected losses of critical forest areas based on future land use patterns.
- Information derived from this study is provided through a GIS-based, interactive tool (GEOBOOK™) that is county specific and useable at the planning and ordinance enforcement level.
Background on the NE Georgia RDC…

- Located in Athens, Georgia
- NEGRDC serves 12 counties and 54 municipal governments in the Northeast Georgia Region
- The agency was created in 1963 to be a focal point for regional issues concerning local government
- The Northeast Georgia service area encompassed by NEGRDC is 3,260 square miles with an estimated population of 438,300
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Northeast Georgia Regional Development Center

- Regional Planning Agency assisting governments regionally and locally with:
  - Planning & Growth Management
  - Land Development Ordinances
  - Environmental Resource Protection
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Project Purpose

- Investigate impacts of sprawl on critical forest land.
  - Urbanization
  - Traffic
  - Loss of Community Character
  - Loss of Quality of Life
  - Environmental Degradation
  - Air Quality
  - Urban-Rural Interface

- Provide interactive, decision-making tool to allow communities to make better decisions to manage critical forest areas and development.
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Project Funding

- National Aeronautics and Space Administration
  - Broad Agency Announcement to Utilize NASA and Commercially Developed Data and Capabilities in Operations and Decision Support
- Northeast Georgia Regional Development Center
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Project Outline

- Vegetation Classification and Canopy Change Analysis
- Attribute data with “urban benefits”
- GEOBOOK™ – Data Delivery Tool
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Background on Space Imaging

- Headquartered in Thornton, Colorado
- IKONOS Satellite – Launched September 1999
  - 1 meter resolution
  - 423 miles above the earth, Circles the earth every 98 minutes, 13 times a day
- Other US Offices: Ann Arbor, MI / Orlando, FL / Ft. Collins, CO / Sacramento, CA / Reston, VA
- Portland, Oregon Office
  - Staff Focus:
    - GIS Analysis
    - Application Development (GEOBOOK™ – Map Objects Lite)
    - Remote Sensing
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Remote Sensing

- Vegetation Layer & Canopy Layer
  - LandSat 5 & 7 TM Imagery (30 meter resolution)
  - ERDAS Imagine version 8.6
  - Cubist

- Change Detection (3 time periods: ’85 to ’91 to ’98 to ’02)
  - LandSat 5 & 7 TM Imagery (30 meter resolution)
  - ERDAS Imaging version 8.6
  - ArcGIS
Using GIS to Evaluate Land Use Change in NE Georgia

Remote Sensing – Vegetation Layer 2002
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Remote Sensing – Canopy Closure Layer 2002
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Space Imaging - Solution

- Change Detection (3 time periods: ’85 to ’91 to ’98 to ’02)
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Deliverables (Space Imaging to NEGRDC)

- 4 Time Periods (’85, ’91, ’98, ’02)
  - Vegetation Layer
  - Canopy Closure Layer

- 3 Change Layer (’85 to ‘91, ’91 to ’98, ’98 to ’02)
  - Definite Loss
  - Possible Loss
  - No Change
  - Possible Gain
  - Definite Gain
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Change in Land Cover

Example of an area that has experienced:

- **Definite Loss** (dark green) from 1985 to 1991

- **Definite Gain** (dark red) from 1991 to 1998

- **Definite Loss** from 1998 to 2002

In the change maps, light red and green are possible gain and possible loss, respectively.
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Change in Land Cover & Land Use

Example of an area that experienced:

- **Definite Loss** (dark green) from 1985 to 1991
- **No Change** (white) from 1991 to 1998 as well as from 1998 to 2002.

The change maps also show areas of definite gain (dark red), possible gain (light red), and possible loss (light green).
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Urban Benefits Attributes

- Canopy Closure
- Energy Budget
- Stream Buffer Width
- Watershed Position
- Soil Capability
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GEOBOOK™

- Environmental Rank
  - Developed in Visual Foxpro®; converted to Visual Basic®.
  - Uses forest polygon attribute data, canopy closure, and end-user weighting factors to calculate Environmental Rank.
  - Program supports 7 urban benefits.
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Forest Features/Benefit Matrix:

<table>
<thead>
<tr>
<th>Forest Type</th>
<th>Riparian Buffer</th>
<th>Slope Class</th>
<th>Soil Capability</th>
<th>Acreage Class</th>
<th>Energy Budget</th>
<th>Watershed Position</th>
<th>Forest Features</th>
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</thead>
<tbody>
<tr>
<td>Water Quantity</td>
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<td>•</td>
<td>•</td>
<td>•</td>
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<tr>
<td>Water Quality</td>
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<td>NA</td>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Benefit Factors</td>
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</table>

Enter Environmental Weights in orange cells for benefit factors.
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GEOBOOK™ (cont’d)

- Final data product is ArcView® shapefile.
- Uses ArcExplorer.
- Provides additional GIS database querying capabilities and enhanced mapping.
- Allows end-user to display forest areas under various environmental rankings.
- Can provide complete spatial analysis capabilities for studies of environmental benefits of forest areas.