Geographic Information Systems (GIS), Global Positioning Systems (GPS) and Remote Sensing in Support of Community & Urban Forestry

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Geographic Information Sciences Laboratory
Tennessee State University

WORKSHOP AGENDA

- Presentation of TSU Geographic Information Sciences Laboratory urban forestry research projects involving GIS, GPS, and Remote Sensing
- Live demonstration of GPS, GIS and remote sensing technology in an urban forest tree survey
- Questions and Answers

Proposal: GIS, GPS and Remote Sensing Applications in an Assessment of the Impacts of Land Use Change upon the Radnor Lake Urban Forest

Submitted to the Community Forestry Research Fellowship Program and the
U.S. Environmental Protection Agency
Environmental Education Grants Program
January-May 2007

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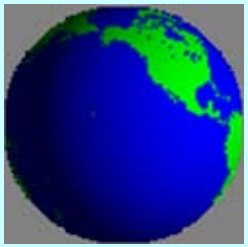
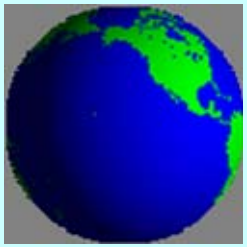
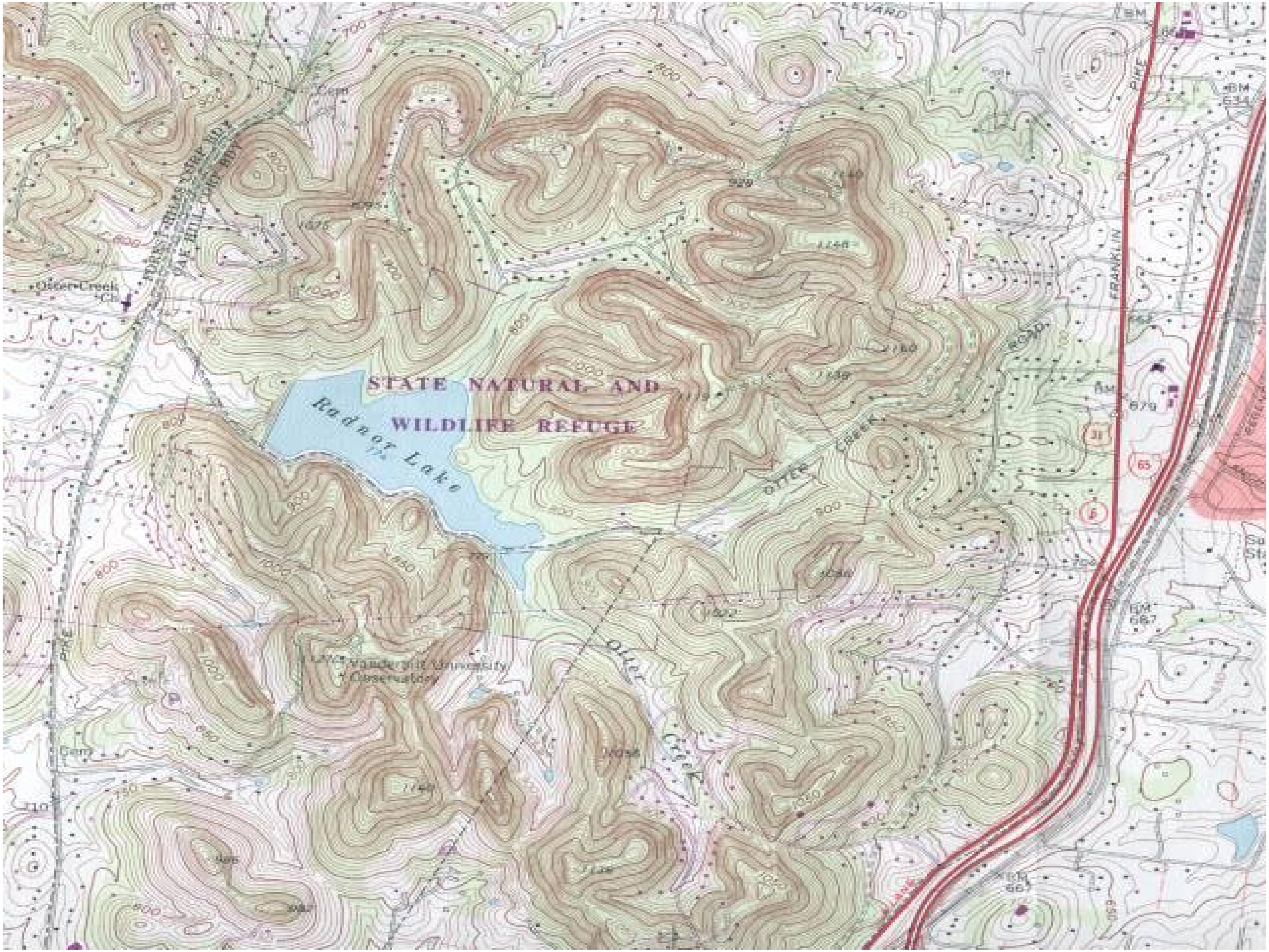
Geographic Information Sciences Laboratory
Tennessee State University
Nashville, Tennessee





THE HISTORY OF RADNOR LAKE

- **The Louisville and Nashville Railroad Company impounded Radnor Lake in 1914.**
- **In 1923 the Tennessee Ornithological Society proposed that the area become a sanctuary for wild life.**
- **In 1962 the area was preserved as a park.**
- **In 1973 Radnor Lake was purchased by the Tennessee Department of Conservation.**


STATE NATURAL AND
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Research Questions

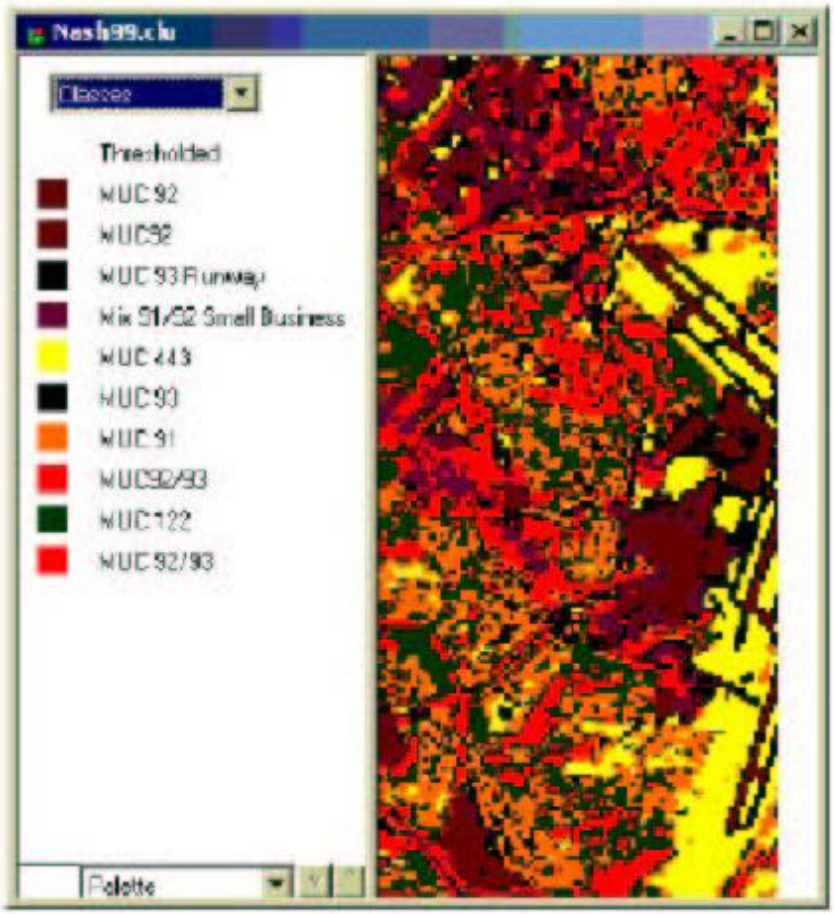
- Will the application of GIS, GPS, and remote sensing technology be effective in determining the extent of the potential impacts of over a decade of land use change upon the Radnor Lake urban forest?
- Can GIS and remote sensing produced imagery be effectively used in support of local environmental education and land use decision making with regard to the potential impacts of land use change upon the Radnor Lake urban forest?

Project Objectives I

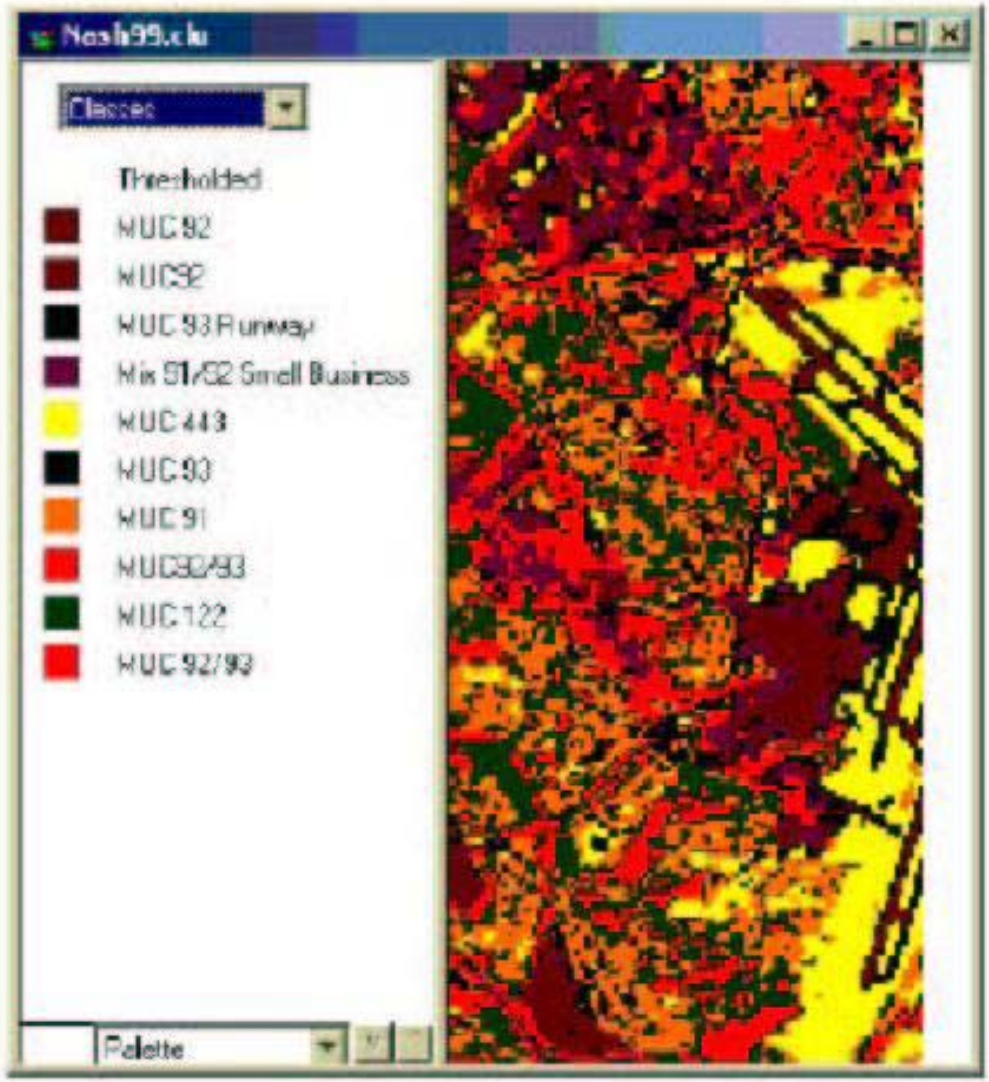
- Apply **CITYgreen** (GIS software) to quantitatively assess the ecological value of the Radnor Lake urban forest.
- Apply **Multispec** (GIS/Remote Sensing software) to produce a land cover map of the Radnor Lake urban forest and environs.

An Example of Student Inquiry

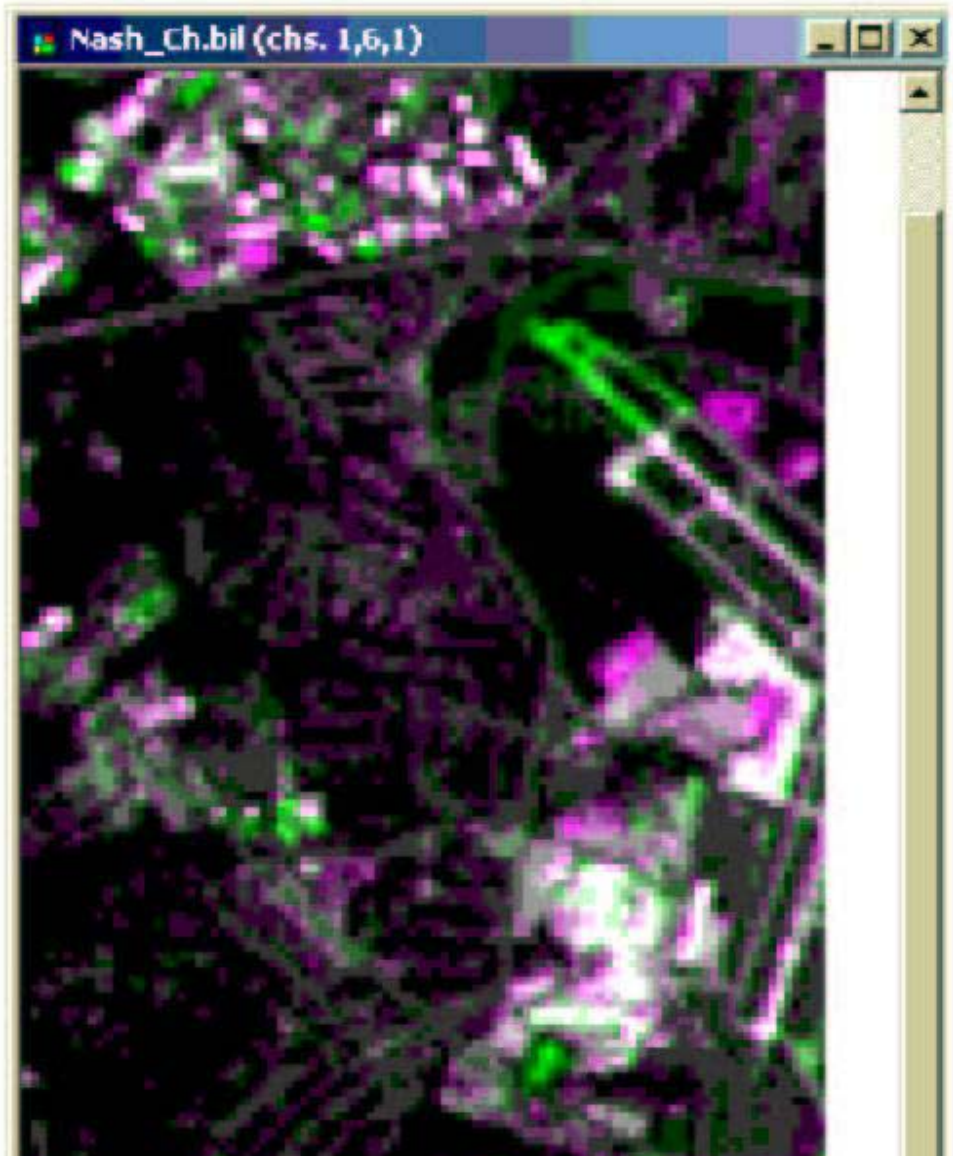
Students in the Nashville, Tennessee, area were investigating change over time around the Nashville International Airport. They knew that during the time between their Landsat 5 and 7 images, the runways at the airport had been lengthened. This group created a computer-assisted land cover map of a portion of their 1992 image that included the airport.



The group then created a map for their 1999 image of the same area.



Examining these maps, they were certain that significant growth had occurred in the airport area over the time between the images. They used the *Change Detection Tutorial* to produce a change image.

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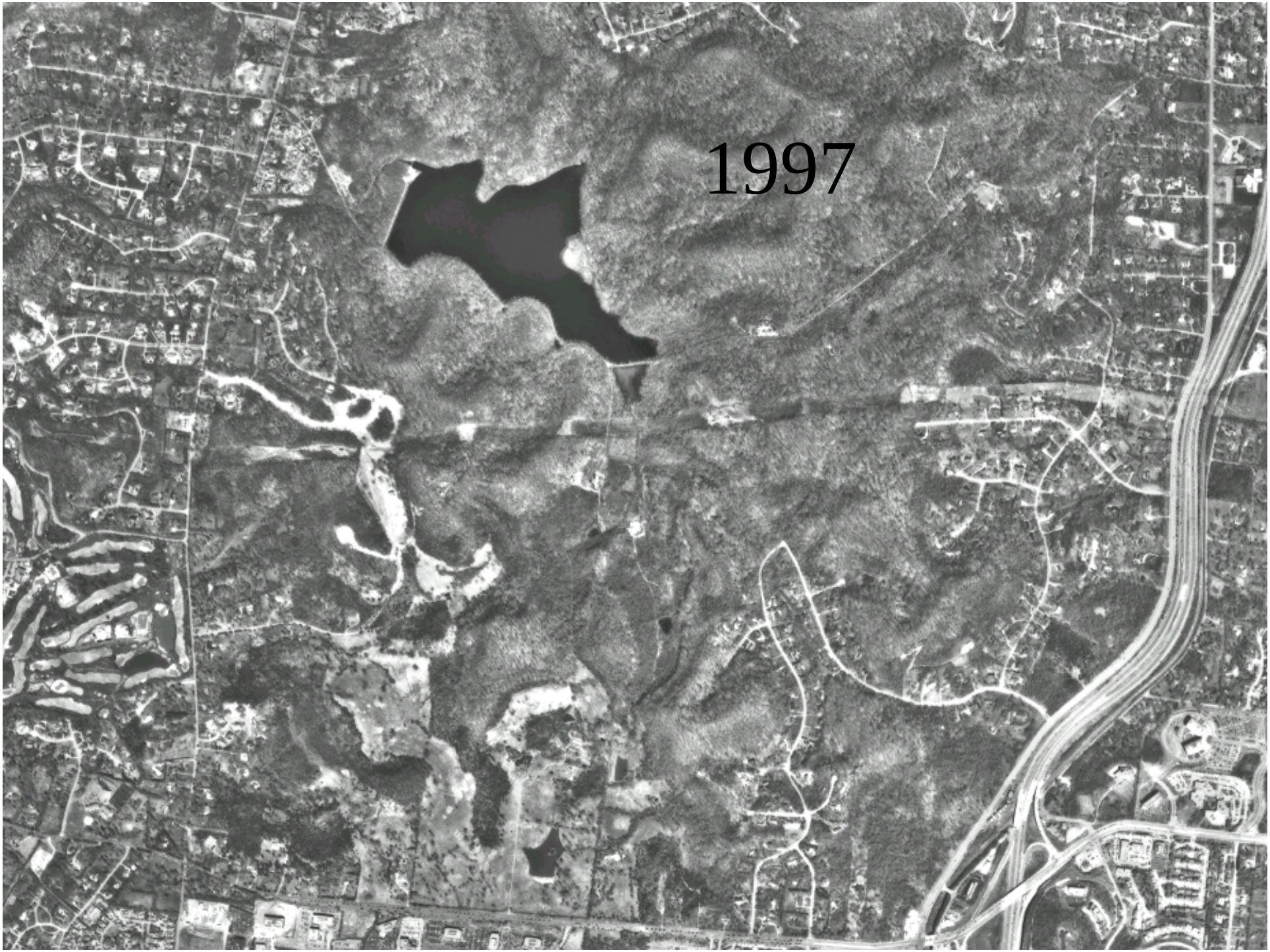
1997


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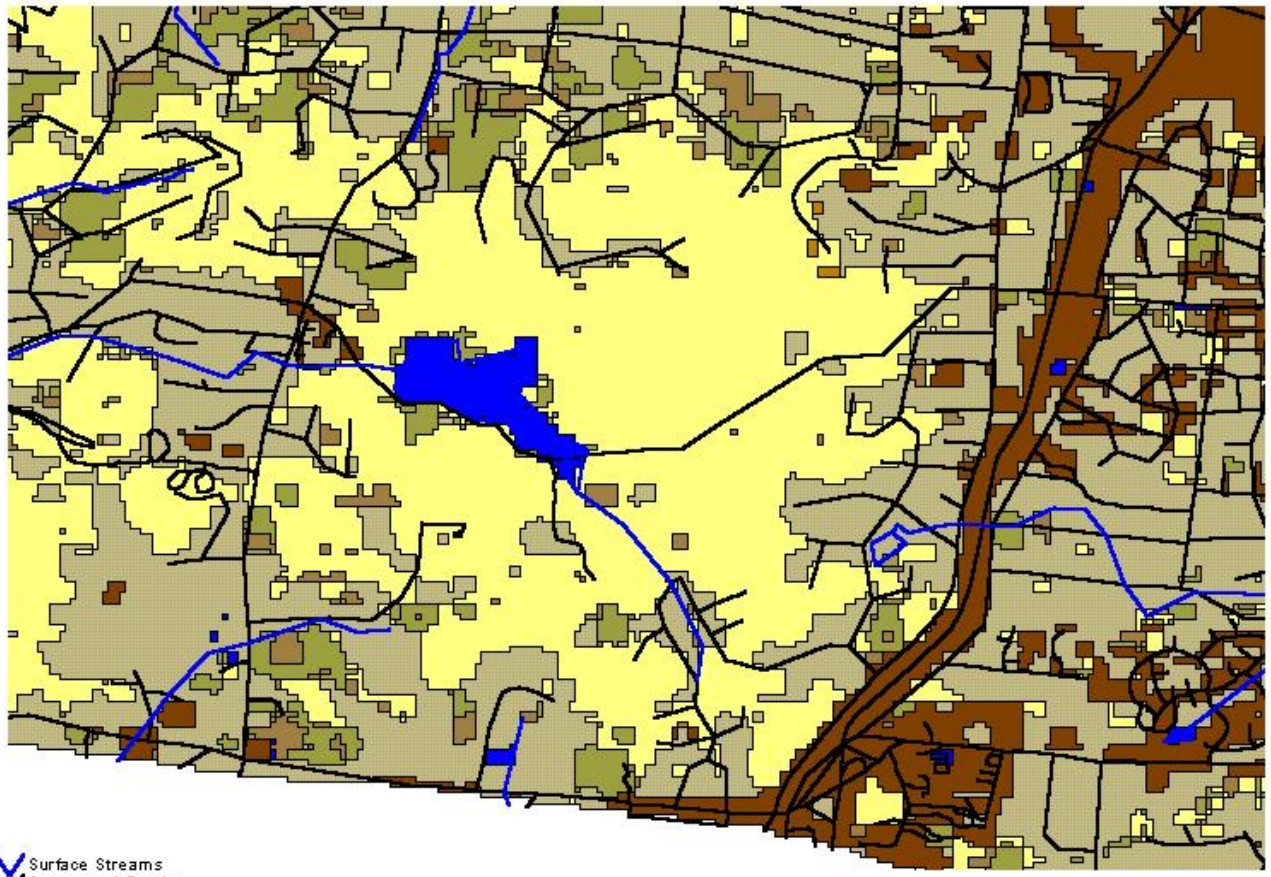
Land Use in the Vicinity of the Radnor Lake Watershed



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Land Use

- Unclassified
- Water
- Wet Deciduous Forest
- Non Forested Wetland
- Pasture
- Row Crop
- Upland Deciduous Forest
- Upland Mixed Forest
- Upland Coniferous Forest
- Urban and Developed
- Non-Vegetated
- Undefined

Surface Streams
Streets and Roads

1 0 1 Miles

Scale 1:34,018

Source: Tennessee Wildlife Resources Agency, Davidson County Landcover GAP Analysis Data

Project Objectives II

- Train and certify up to six local k-12 teachers in the Global Learning and Observations to Benefit the Environment (GLOBE) www.globe.gov Land Cover Protocols.
- Train two Friends of Radnor Lake volunteers and two undergraduate students in GIS, GPS, and remote sensing applications.

PROJECT TIMELINE - 2007

July 2006	August	September	October	November	December
[redacted]					
Complete canopy cover assessment with MultiSpec software.					
[redacted]					
Develop GLOBE Land Cover Protocol teacher training workshops.					
[redacted]					
GLOBE Land Cover Protocol teacher training workshop.					
[redacted]					
Train two Friends of Radnor Lake volunteers in GIS/Remote sensing applications in urban forestry.					
[redacted]					
Train two TSU students in GIS, GPS, and remote sensing techniques in urban forest analysis.					
			[redacted]		
			Complete urban forest ecological assessment		
			using CITYgreen software.		
			[redacted]		
			Attend the 2007 Tennessee		
			Urban Forest Conference		

Expected Results

- Land use change maps of Radnor Lake and environs will strengthen the arguments for protecting the area from the negative impacts of nearby residential and commercial development.
- The CITYgreen output will reveal the amounts of storm water runoff absorbed by the watershed's urban forest and associated flora.
- The teachers and volunteers trained will use the maps to support future environmental education and outreach efforts.

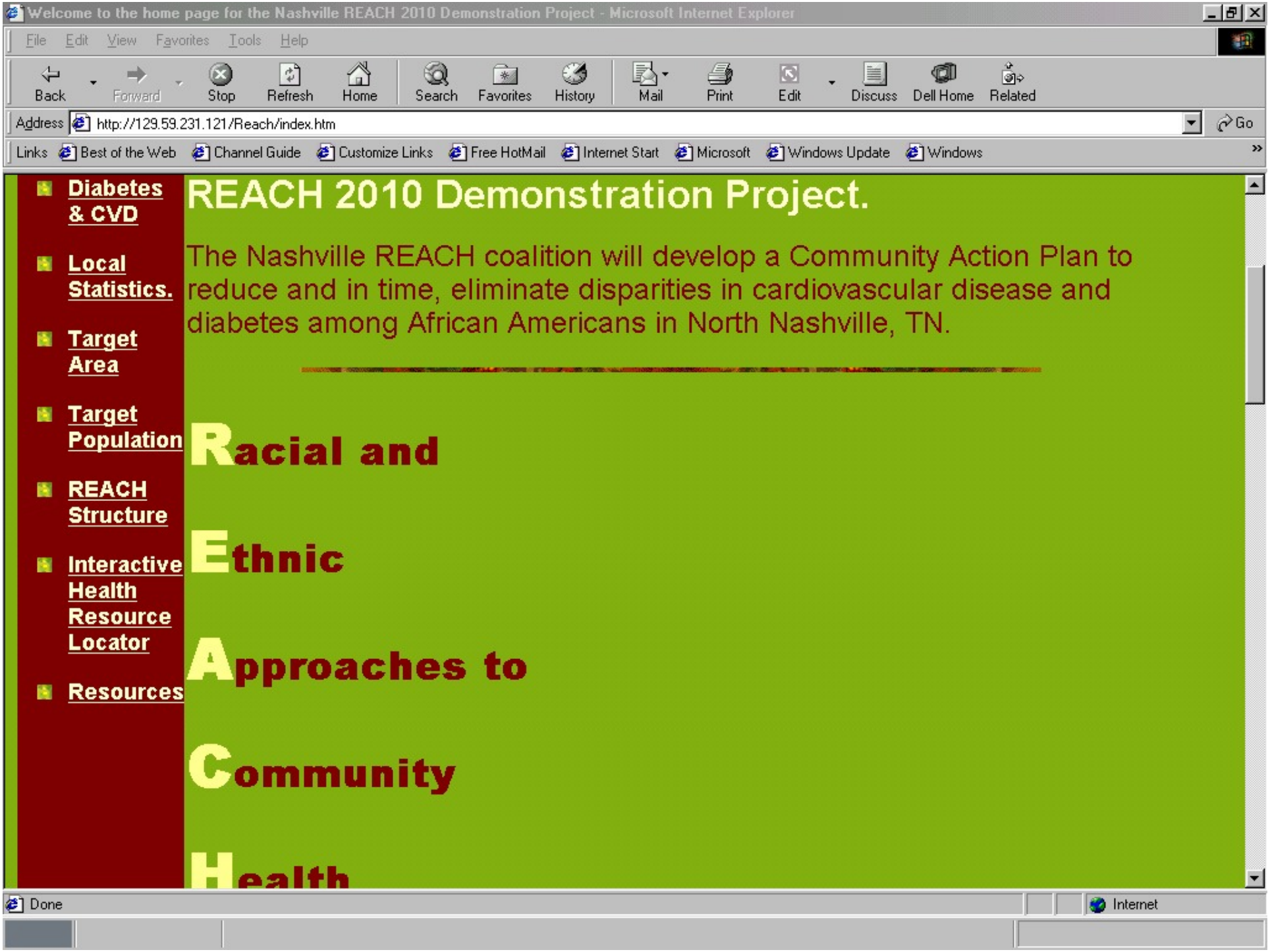
References/Contact

- Radnor Lake State Park
  http://www.state.tn.us/environment/parks/parks/RadnorLake/
- Friends of Radnor Lake
  http://www.radnorlake.org/
- TSU Geographic Information Sciences Lab
  http://www.gislabtsu.freehomepage.com/gislab.htm
  Crouch Hall Room 213, TSU Box 9538,
  3500 John A. Merritt Boulevard,
  Nashville, TN 37209
  (615) 963-5508
  dpadgett@tnstate.edu

SYNTHESIZING COMMUNITY FORESTRY AND PUBLIC HEALTH: A BLACK HISTORY/URBAN FORESTRY WALKING TRAIL

Dr. David A. Padgett, Associate Professor of Geography and Director of the Geographic Information Sciences Lab, Tennessee State University, Nashville, Tennessee

Proposal submitted to the "Take Action: Healthy People, Places, and Practices in Communities Grant Program" March 2007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Diabetes & CVD
Local Statistics.
Target Area
Target Population
REACH Structure
Interactive Health Resource Locator
Resources
REACH 2010 Demonstration Project.
The Nashville REACH coalition will develop a Community Action Plan to reduce and in time, eliminate disparities in cardiovascular disease and diabetes among African Americans in North Nashville, TN.
Racial and
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Approaches to
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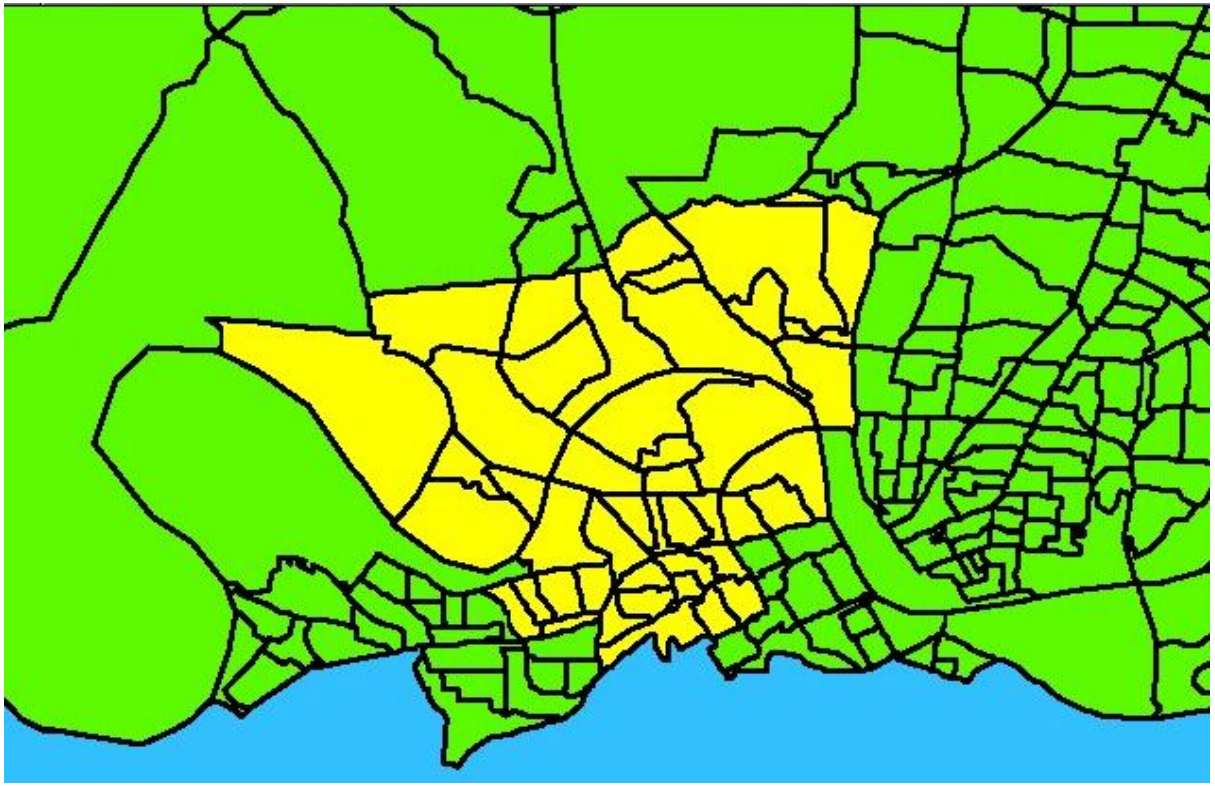
Premature Death Factors: North Nashville (data compiled by Nashville REACH project)



Census tracts comprising REACH study area.

Premature Death Factors: North Nashville (data compiled by Nashville REACH project)

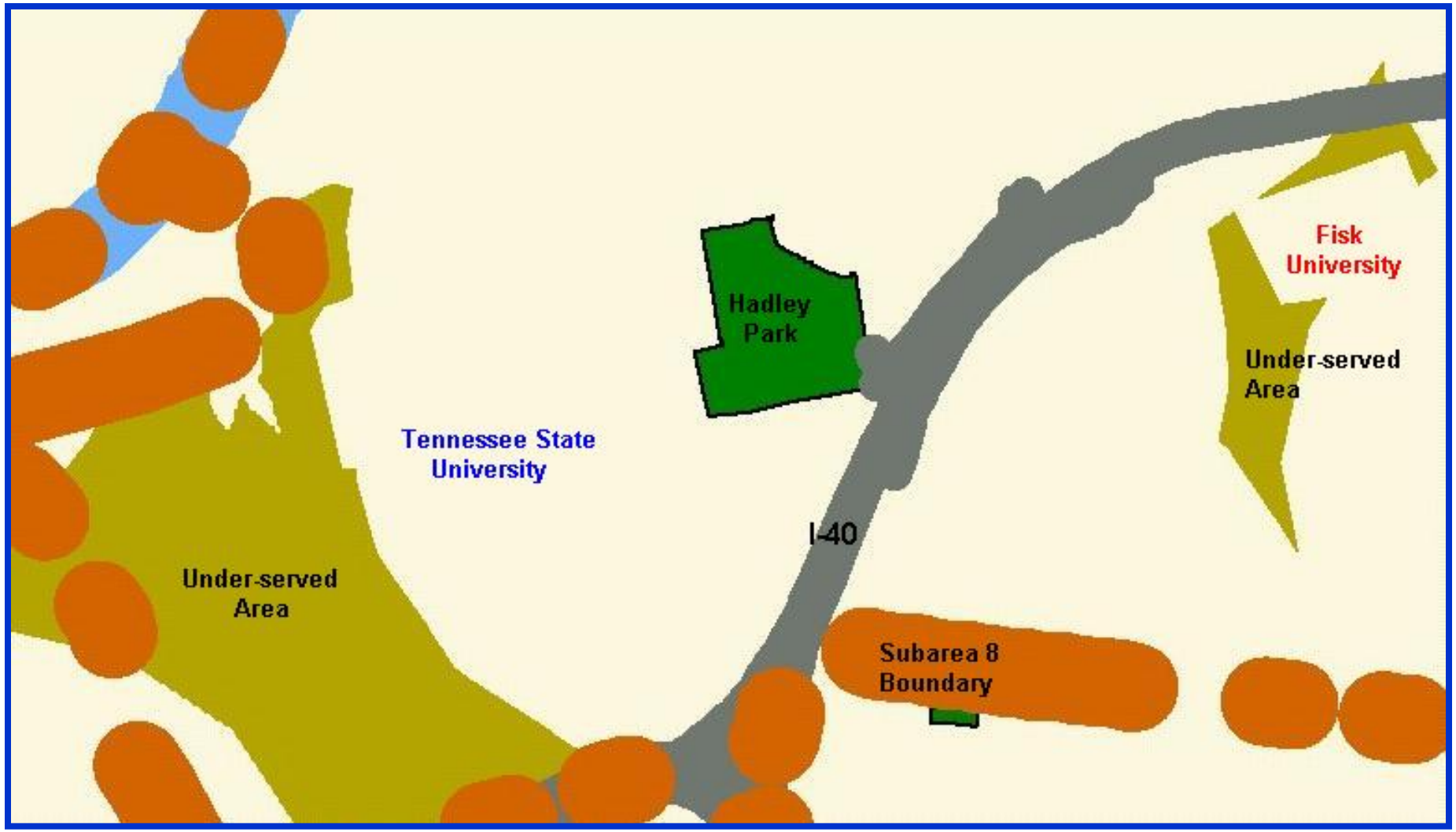
- **The 1997 age-adjusted death rate due to diabetes for African Americans in North Nashville (54.3 per 100,000) was almost 4 times as high as the rate for whites in Davidson County.**
- **The 1997 age-adjusted death rate due to stroke for African Americas in North Nashville (52.6 per 100,000) was nearly twice as high as the rate for whites in Davidson County.**
- **The 1997 age-adjusted death rate due to heart disease for African Americans in North Nashville (224.0 per 100,000) was approximately 1.5 times as high as the rate for whites in Davidson County.**

Inadequate Exercise Factors: North Nashville (data compiled by Nashville REACH project)

- African American females had the highest percentage (82%) “at risk due to inadequate exercise” among the racial-gender groups surveyed.
- African American females had the lowest percentage (69%) who had exercised in the past 30 days among the racial-gender groups surveyed.
- African American females were nearly twice as likely to be “overweight” than white females according to their recommended weight/height ratio.

Research Questions

- Is the lack of physical activity among African Americans in Nashville associated with lack of walkable green space?
- If provided a greater connection to the local urban forest, making it more conducive to physical activity, would North Nashville's African American population become more physically active?



Map of residents accessibility to park space in North Nashville. The areas labeled “underserved” represent populations greater than one-half mile away from park space. Modified from Nashville Metro Parks Plan (2002)

PROJECT OBJECTIVES

- Use GIS and GPS to create a model of a proposed Black History/Urban Forestry Walking Trail connecting the campuses of TSU, Fisk University, and Meharry Medical College.
- Develop and then administer a survey instrument, accompanied by a live demonstration of the trail model, to determine the potential for the trail to induce local residents to become more physically active.

PROJECT METHODOLOGY

- Select historical markers and significant trees in the TSU, Fisk, and Meharry campus communities.
- Determine the selected trees' species, common names, and physical attributes.
- Use GPS to attain the latitude/longitude of the trees selected for the trail.
- Upload the trees' location, digital photographs and attribute data into ArcGIS software.
- Create a model of the walking trail using ArcGIS.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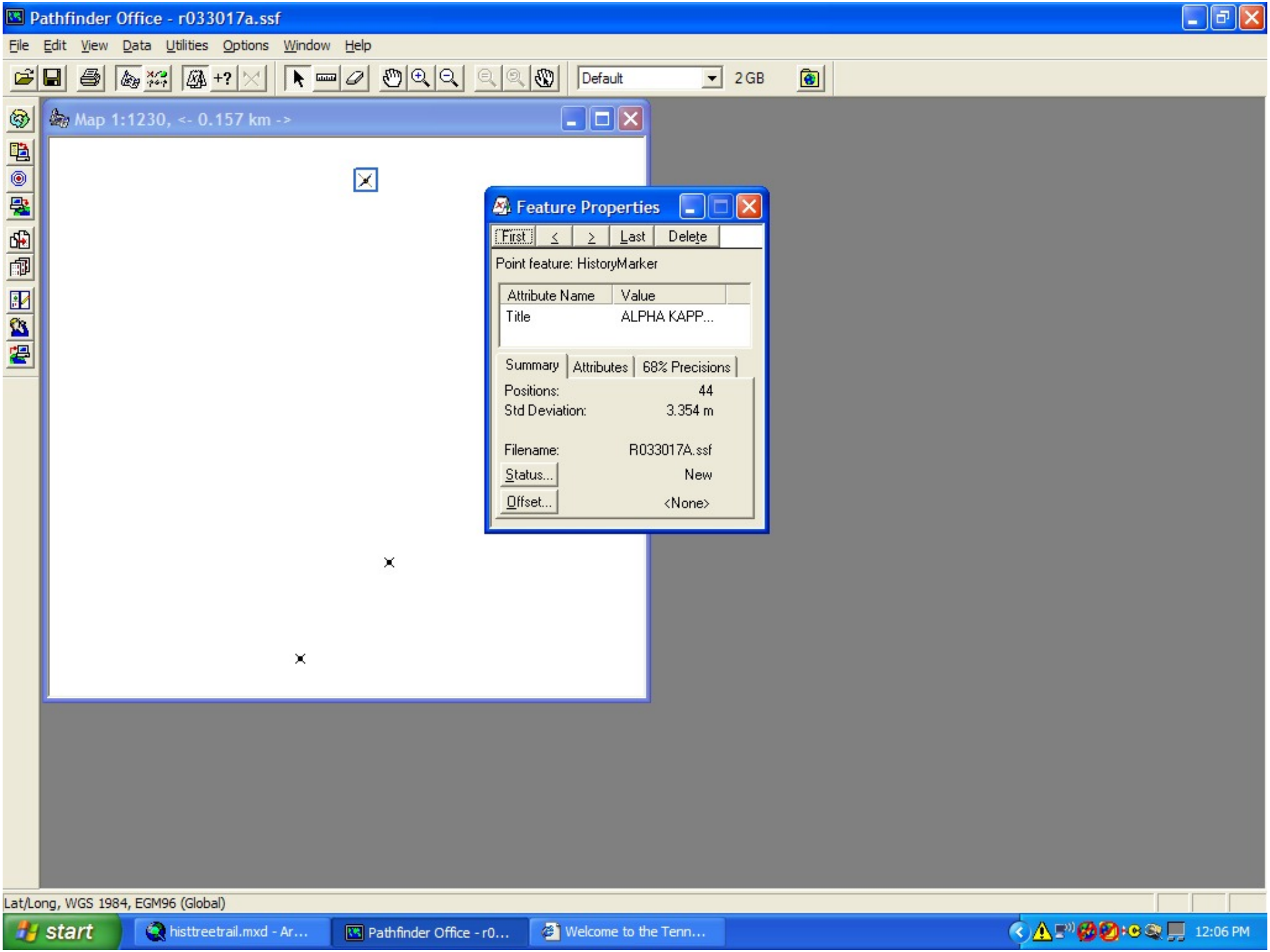
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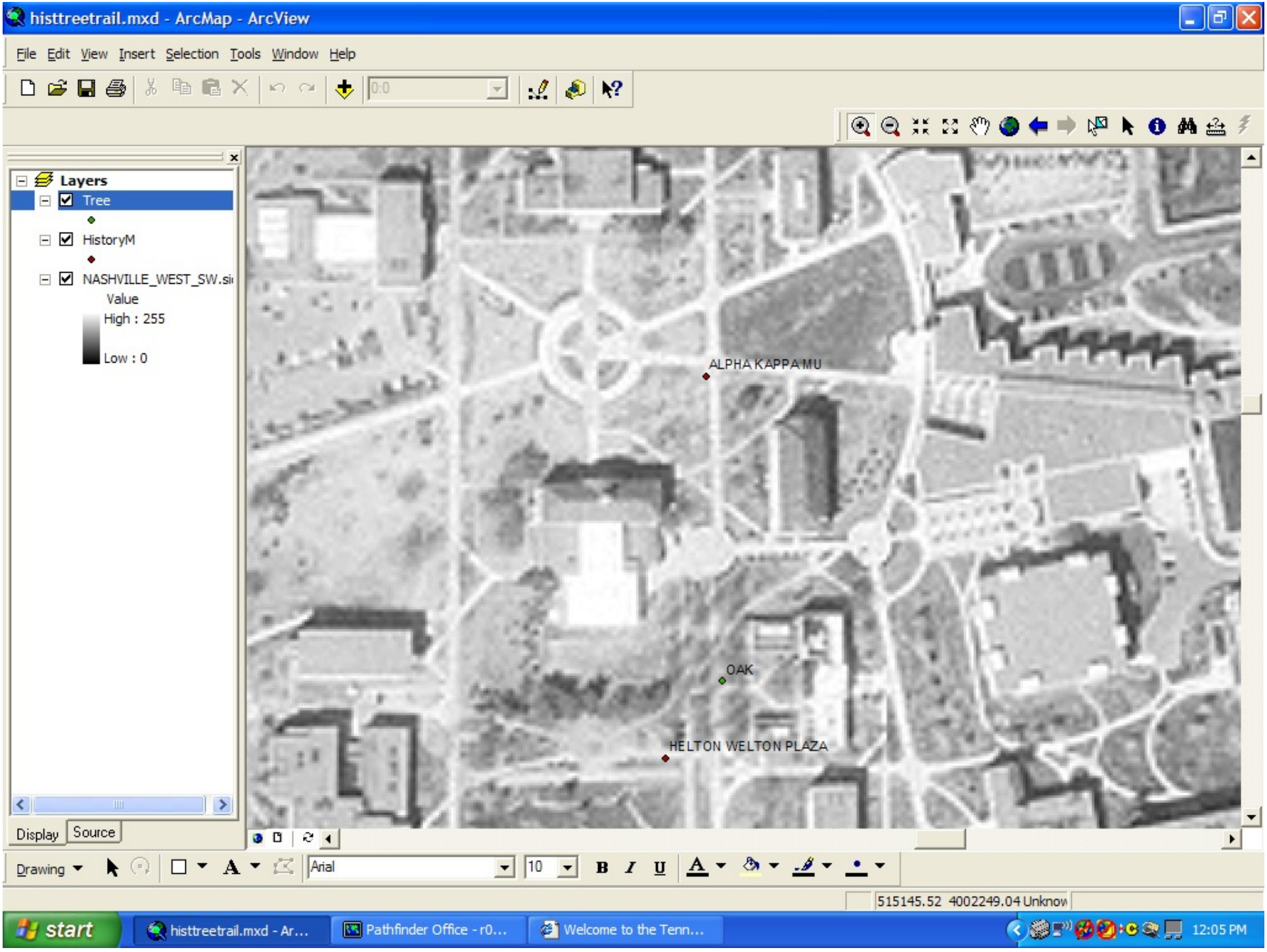
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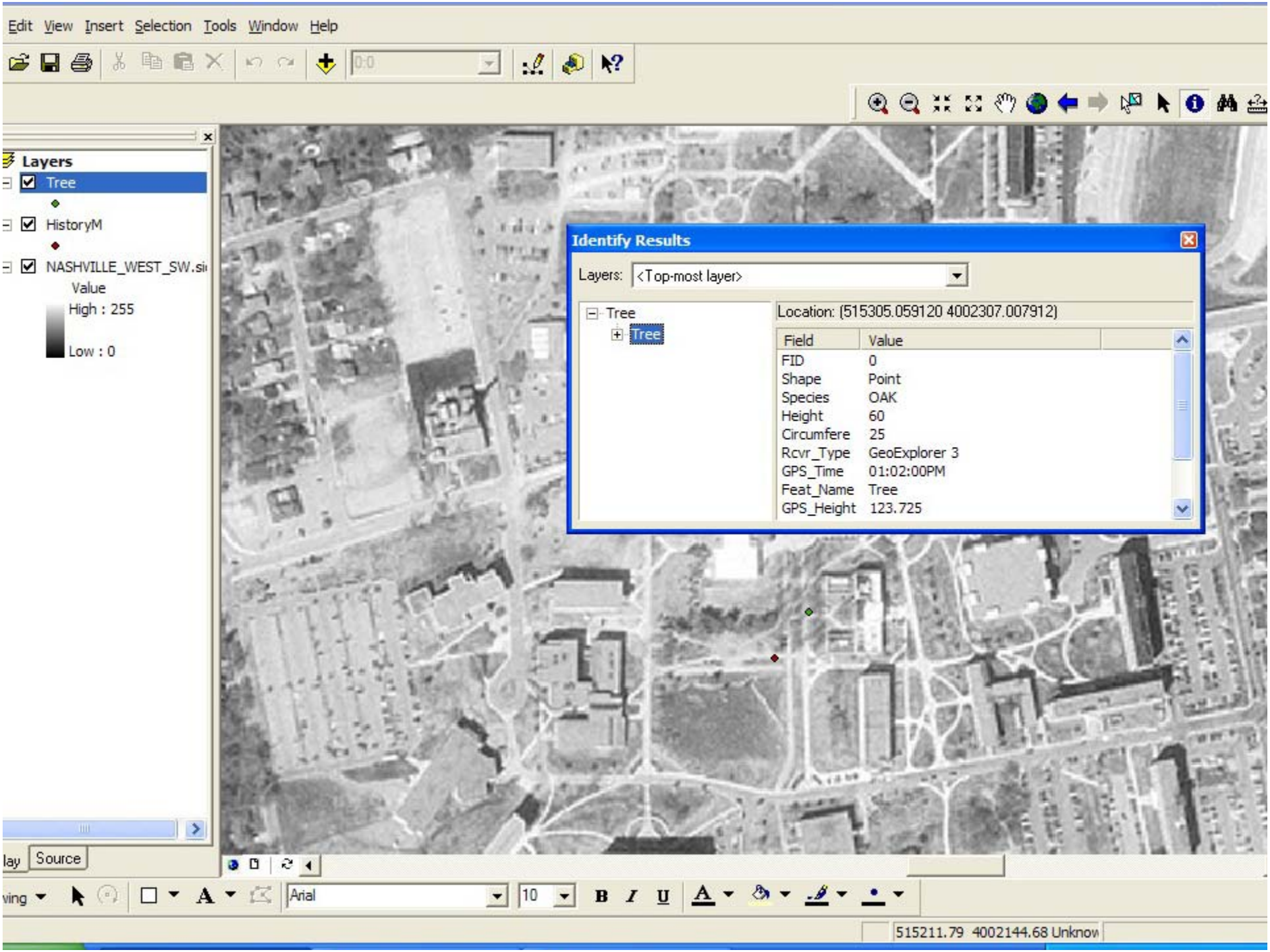
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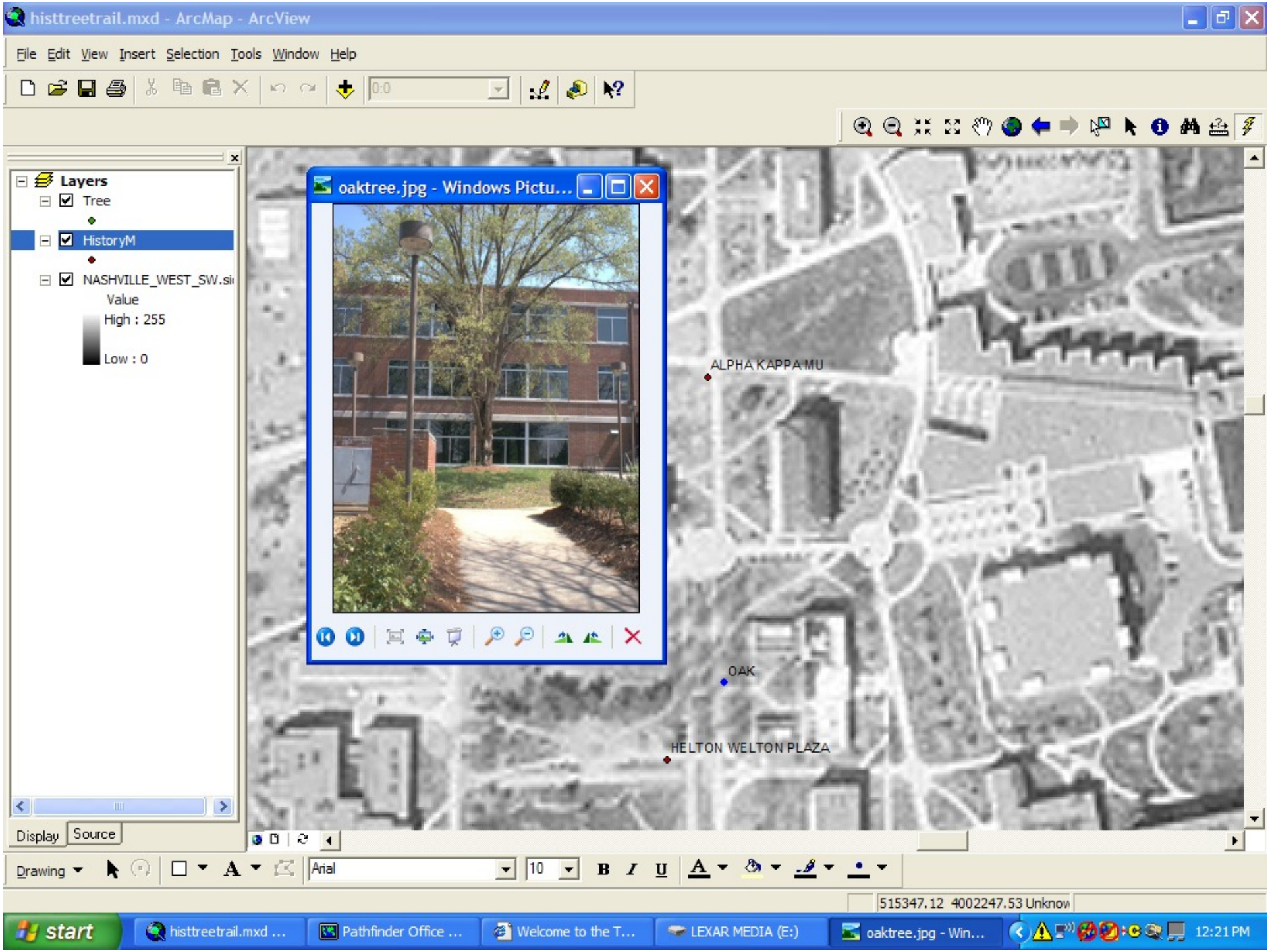
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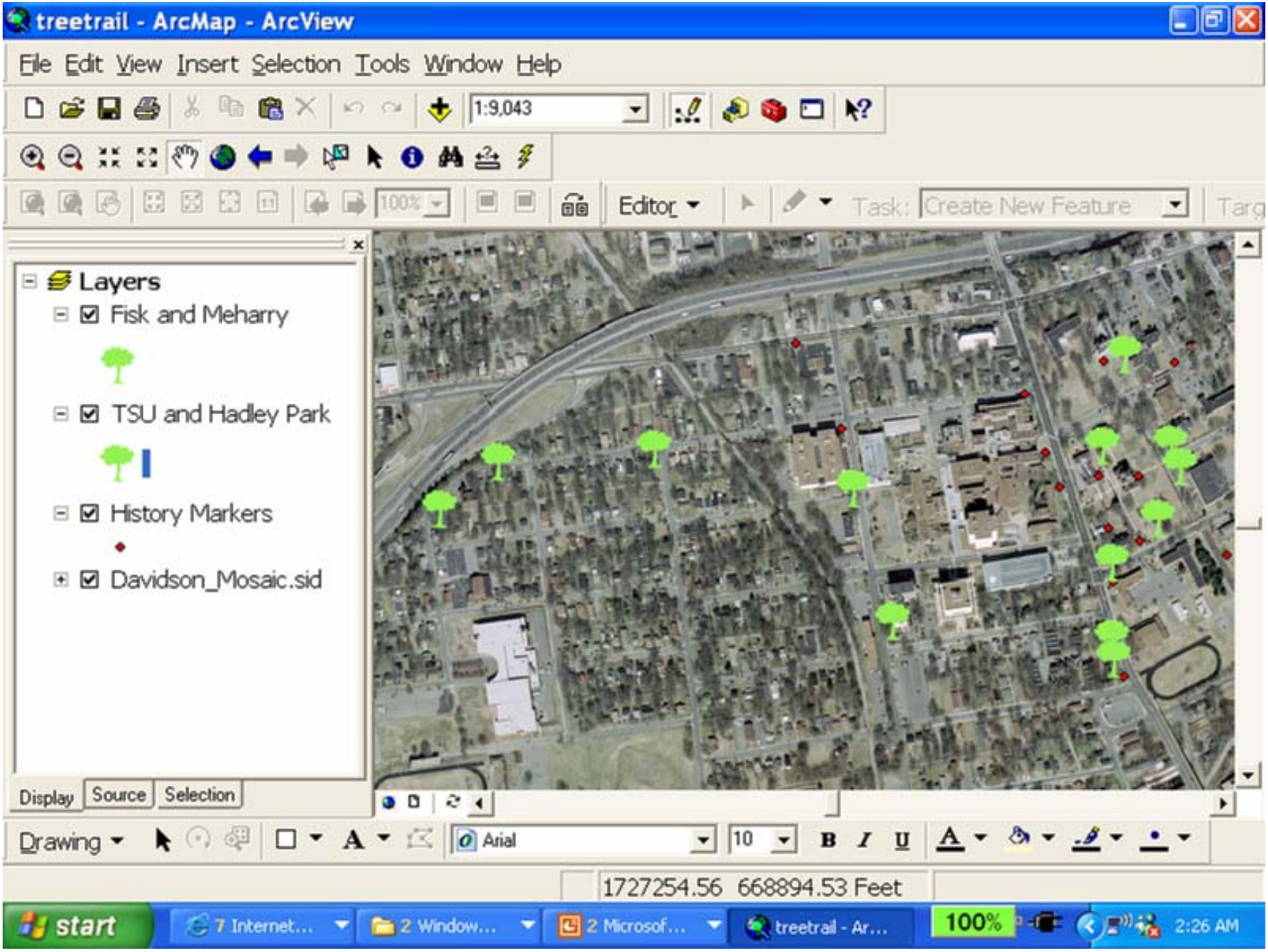
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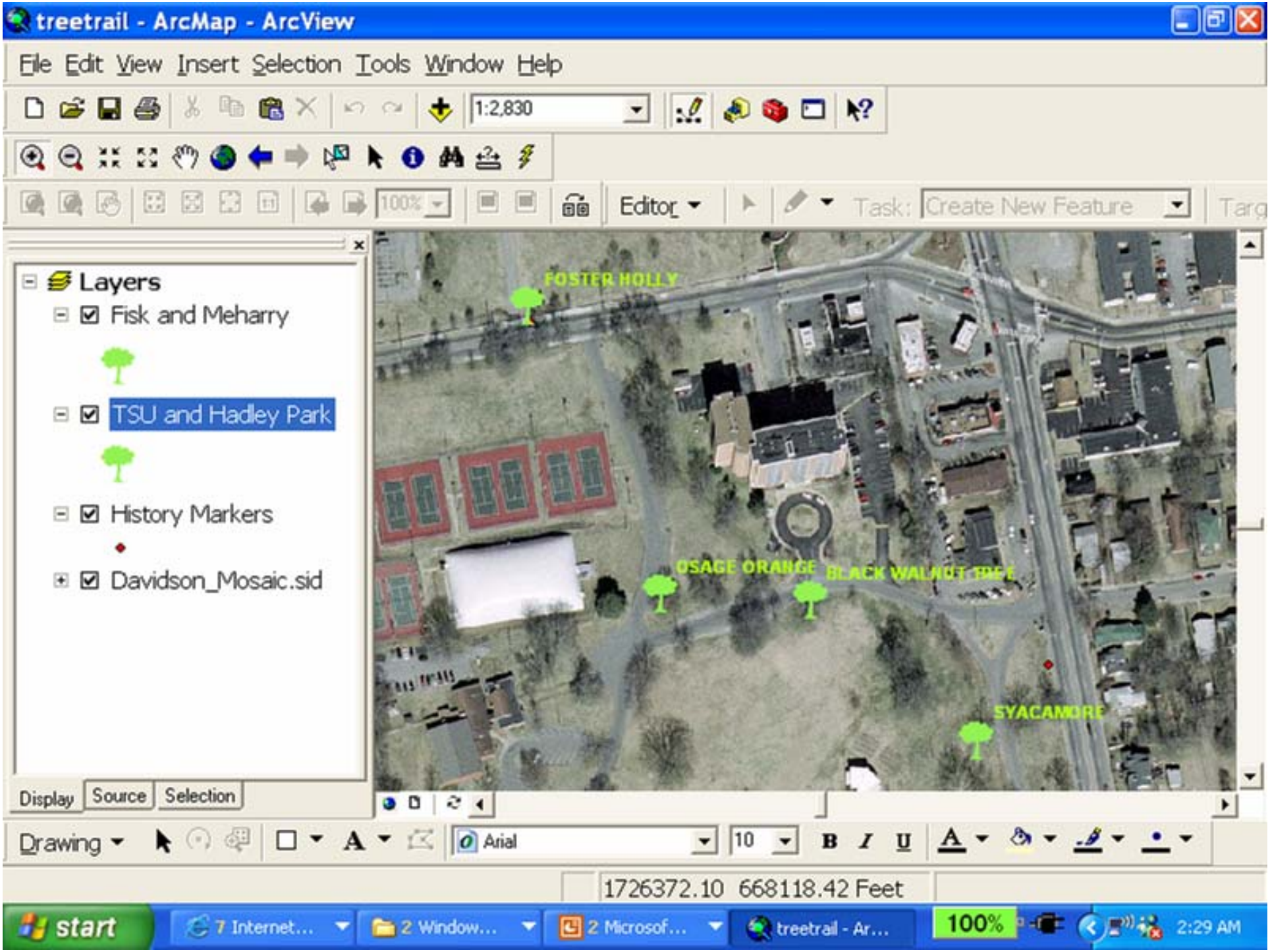
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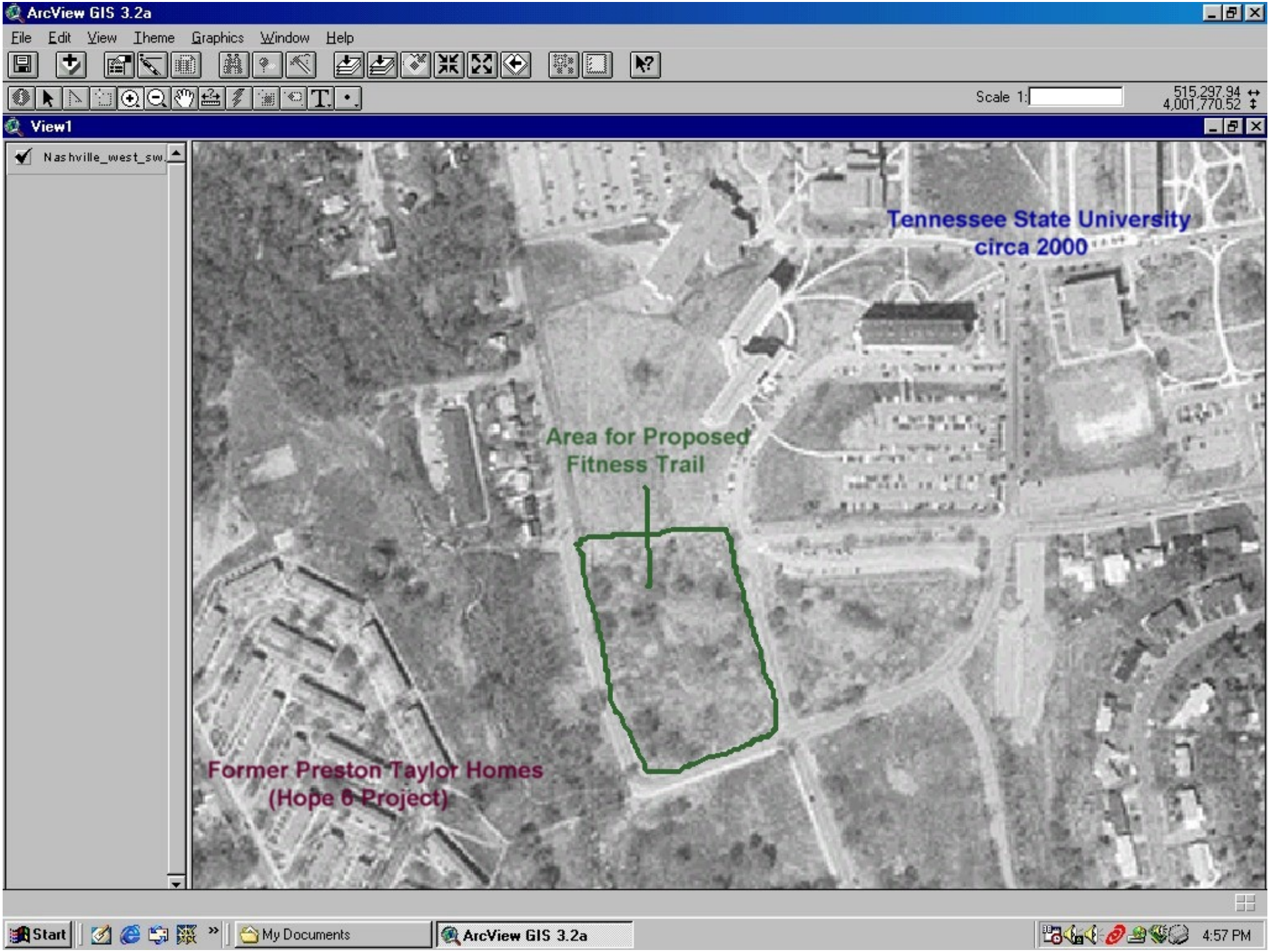
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COMMUNITY PARTICIPATION

- Local health professionals from Meharry Medical College, the Matthew Walker Comprehensive Medical Center, and the Nashville/Davidson County Metropolitan Health Department were consulted to assist in the development of a survey instrument to be administered to potential trail users.
- The surveys will be administered in “focus group” settings by a TSU Health Science major to be determined.
- Survey results will be analyzed to determine the potential for the walking trail to induce local residents to become more physically active.
- If it is determined that significant demand for the trail exists in the community, a proposal for development may be presented to the local government and TSU, Fisk, and Meharry

ACKNOWLEDGEMENTS

Dr. Joshua Idassi, Research Professor, TSU Agriculture Extension Program

Dr. Chris Catanzaro, Forester and Research Professor, TSU Agriculture Extension Program

Dr. Nat Appleton, Research Professor, TSU Agriculture Extension Program

Mr. Kwame Lillard, Executive Director, African American Cultural Alliance, Inc.

Juan Salter, History Major, Tennessee State University, Community Forestry Research Fellow, Summer 2005

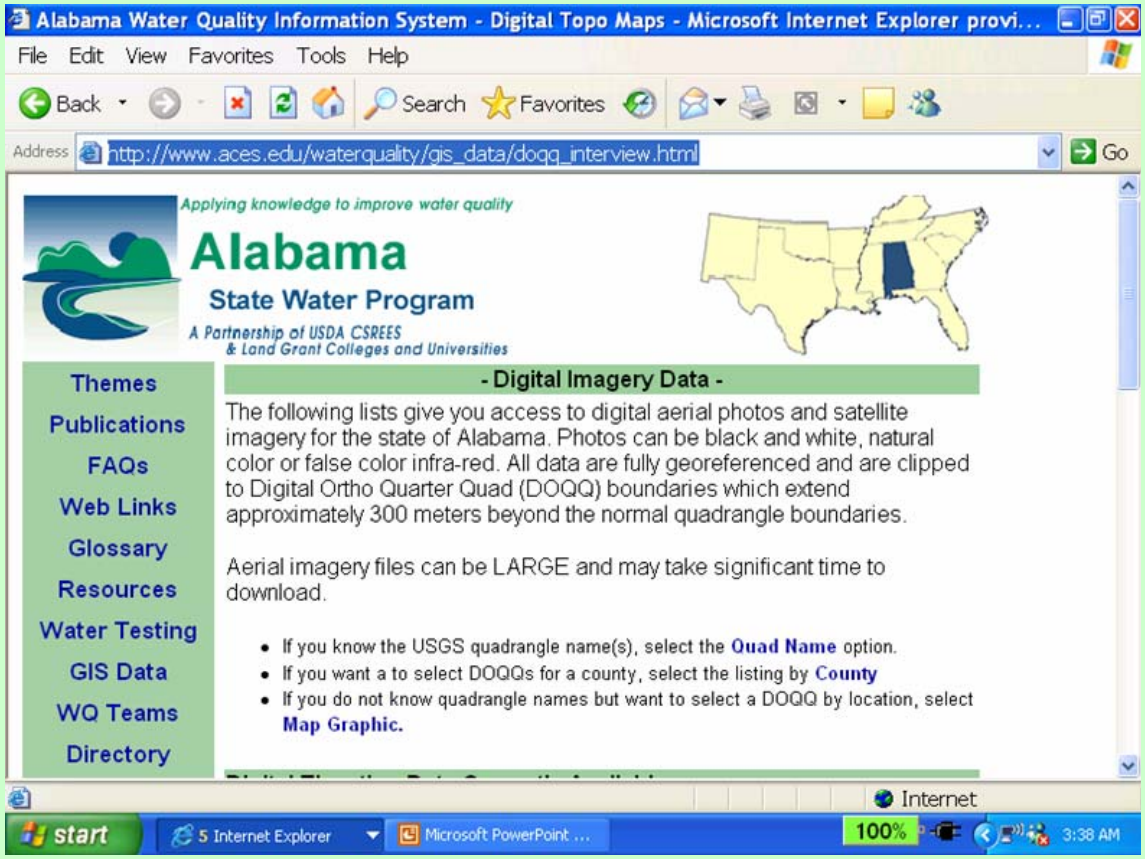
ACKNOWLEDGEMENTS

The Community Forestry Research Fellowship Program

http://www.cnr.berkeley.edu/community_forestry/

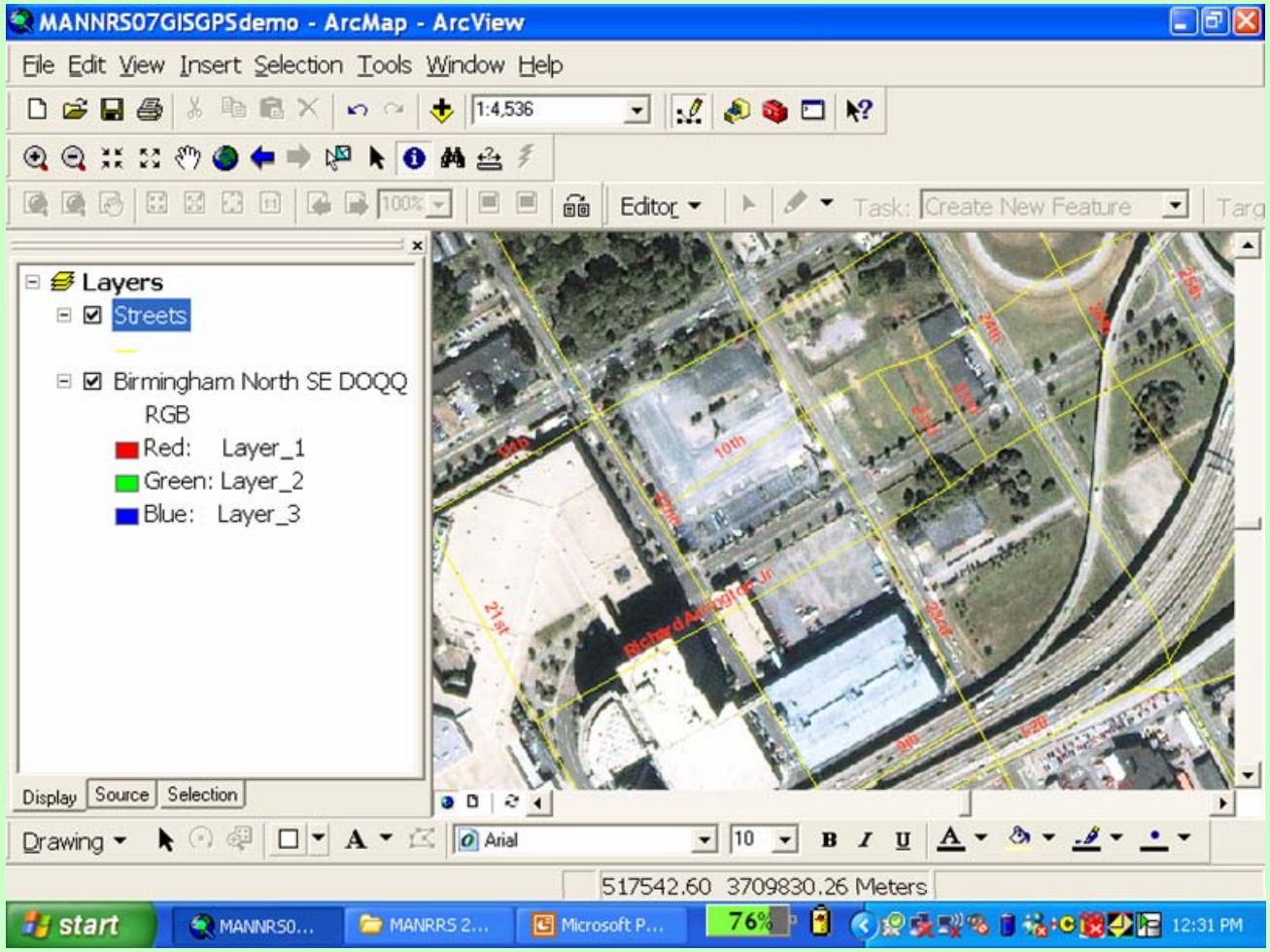
Urban Tree Survey Exercise

Download spatial data from online sources - The Geography Network (www.geographynetwork.com) and - the Alabama Water Quality Information System (http://www.aces.edu/waterquality/gis_data/doqq_interview.html)–
Note that data are based upon the North American Datum of 1983 (NAD 83).



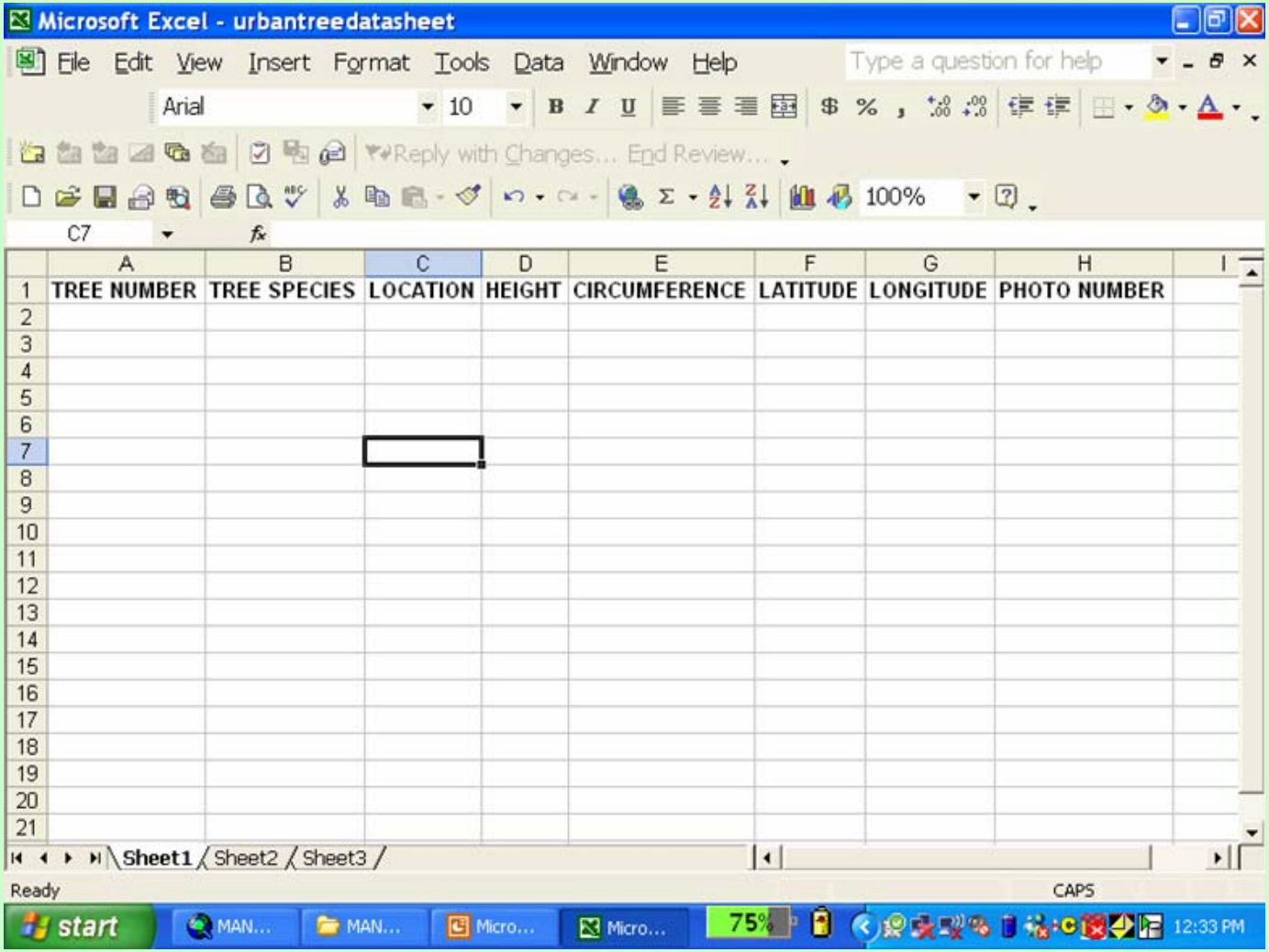
Urban Tree Survey Exercise

- **Open the downloaded ArcGIS shapefiles and Digital Ortho Quarter Quad(s) in ArcGIS**



Urban Tree Survey Exercise

Create Tree Survey Spatial Data Spreadsheet

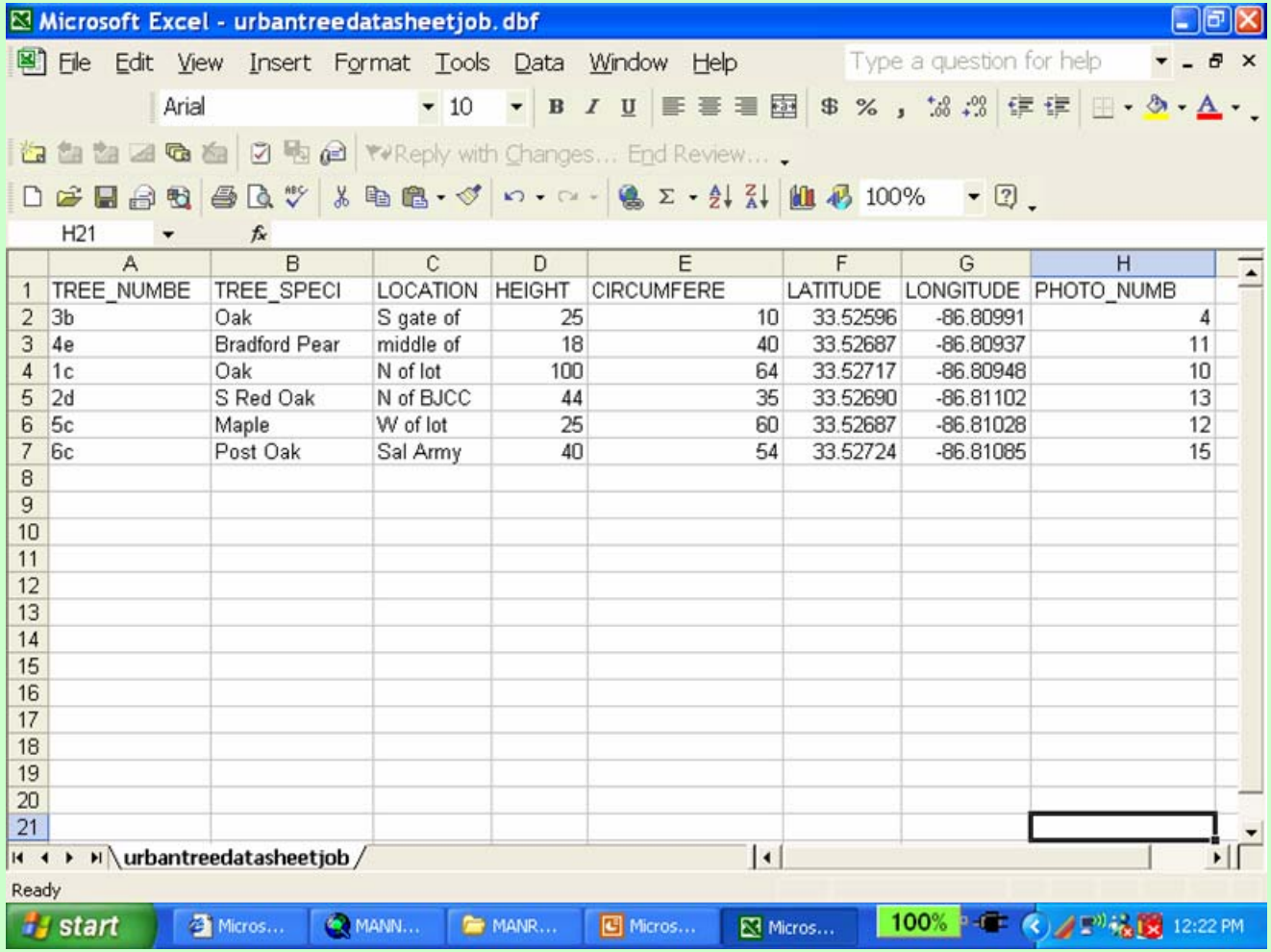


Urban Tree Survey Exercise

Collect Urban Tree Data Using a Hand-Held GPS Receiver – Let's go outside!!!

Urban Tree Survey Exercise

- **Urban Tree Survey Exercise Data Spreadsheet – Saved in dBASE (*.dbf) Format**



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4	1c	Oak	N of lot	100	64	33.52717	-86.80948	10
5	2d	S Red Oak	N of BJCC	44	35	33.52690	-86.81102	13
6	5c	Maple	W of lot	25	60	33.52687	-86.81028	12
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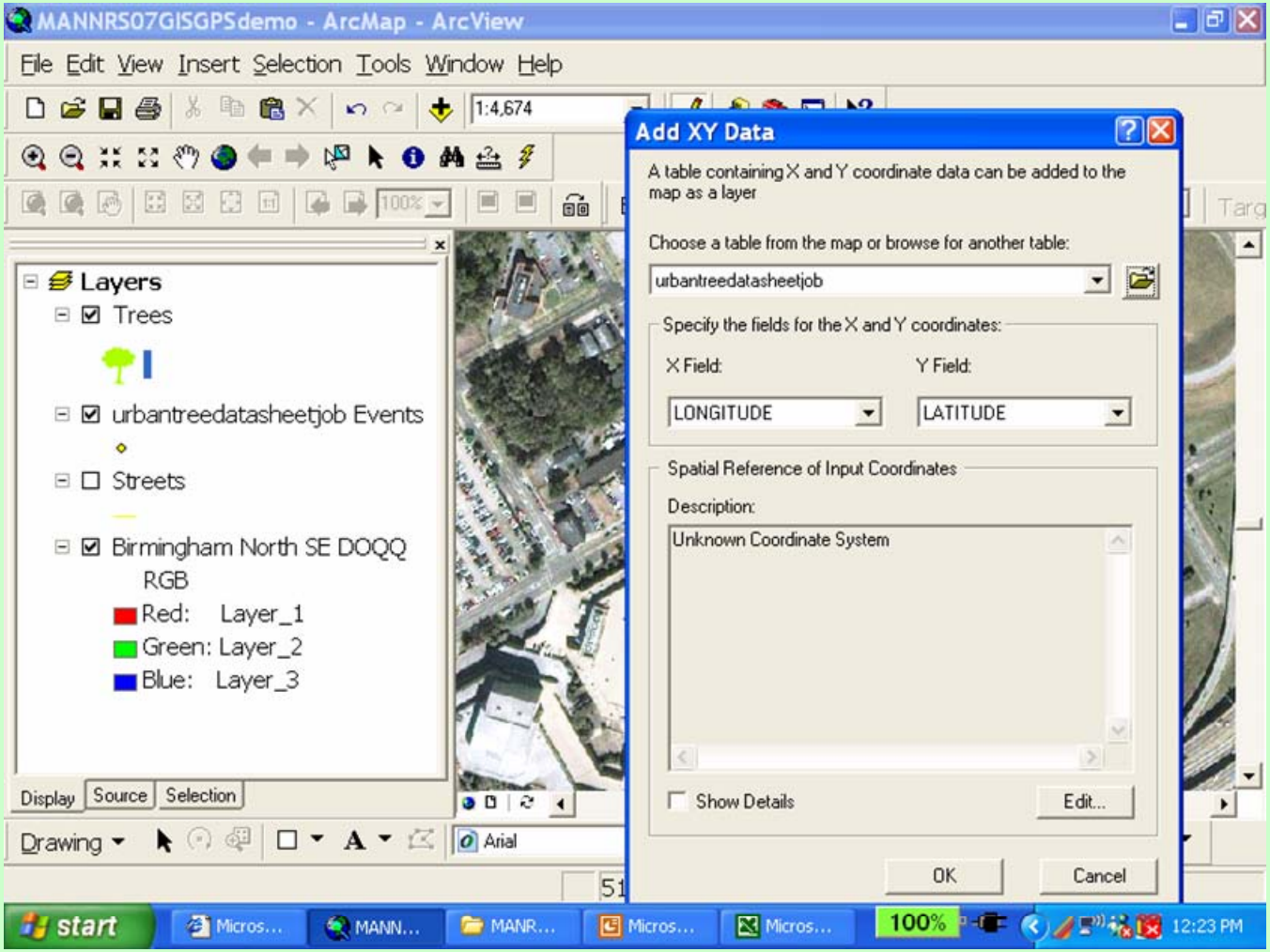
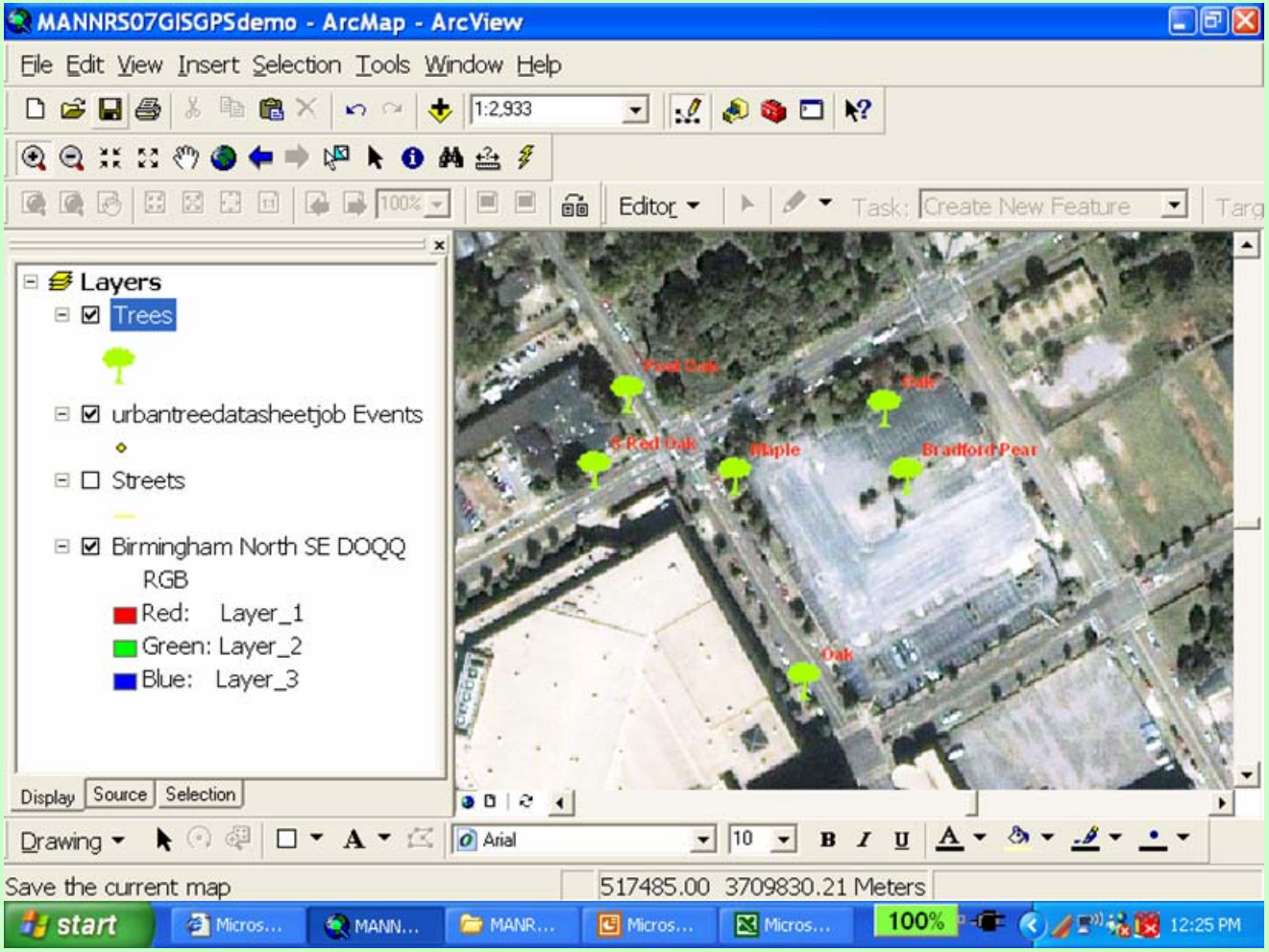
Urban Tree Survey Exercise

- **Urban Tree Survey dBASE file imported into ArcGIS using the “add XY data” function.**



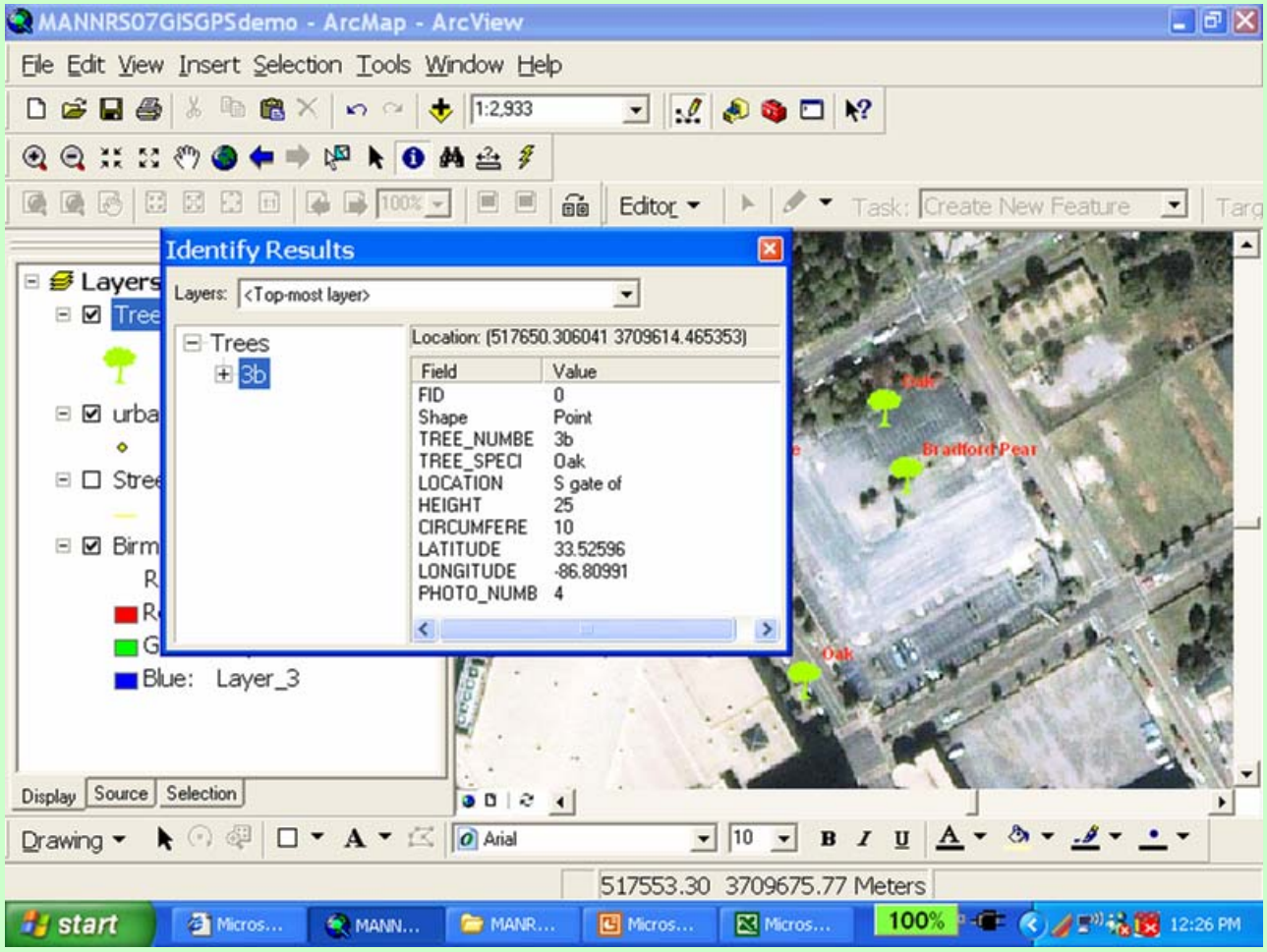
Urban Tree Survey Exercise

- **Urban Tree Survey Data in ArcGIS with Trees Labeled.**



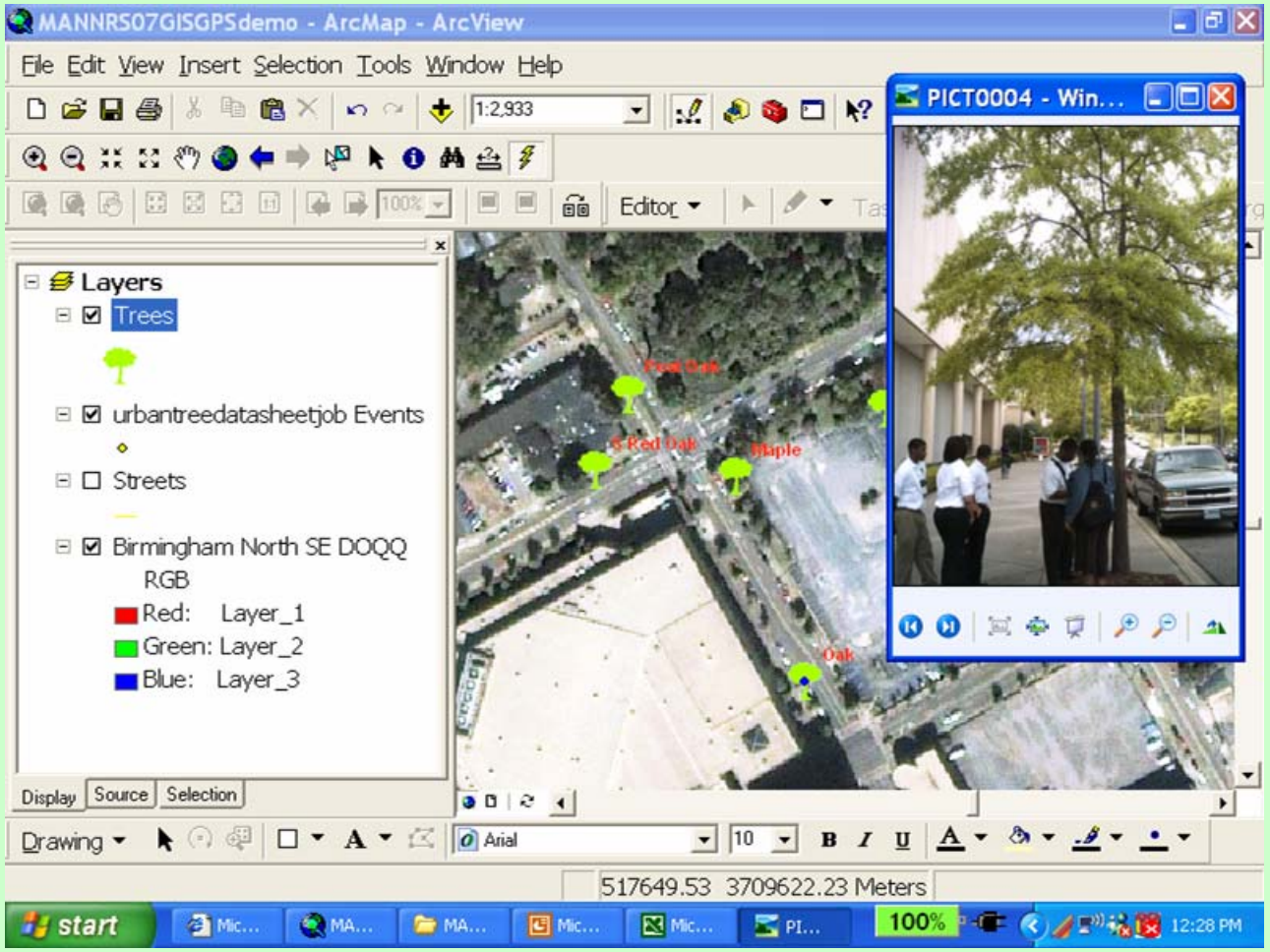
Urban Tree Survey Exercise

- **Urban Tree Survey Data in ArcGIS with Attribute Table Pop-Up Box.**



Urban Tree Survey Exercise

- **Urban Tree Survey Data in ArcGIS with Hyperlinked Photograph Pop-Up Box.**



Workshop End Notes

- **Fairly accurate work can be done even with relatively inexpensive GPS receivers due to Selective Availability being ended in the year 2000.**
- **The receiver must lock in on at least four satellites in order to get an accurate location.**
- **Always make note of the number of satellites locked in when collecting data.**
- **Buildings and dense forest canopy may interfere with the GPS signal.**

Getting Started:
GIS and Spatial Data Resources

- The Geography Network (www.geographynetwork.com)
- The U.S. Bureau of the Census (www.census.gov)
- The HBCU GIS Users Discussion Group (http://groups.yahoo.com/group/hbcugis/)
- The Remote Sensing Core Curriculum (http://www.r-s-c-c.org/)

Getting Started:
GIS and Spatial Data Resources

- USGS GIS Tutorial (http://erg.usgs.gov/isb/pubs/gis_poster/)
- NRCS National Cartography and Geospatial Center (http://www.ncgc.nrcs.usda.gov/)
- GPS Tutorial (http://www.colorado.edu/geography/gcraft/notes/gps/gps_f.html)
- USGS National Mapping Information Site (http://mapping.usgs.gov/)

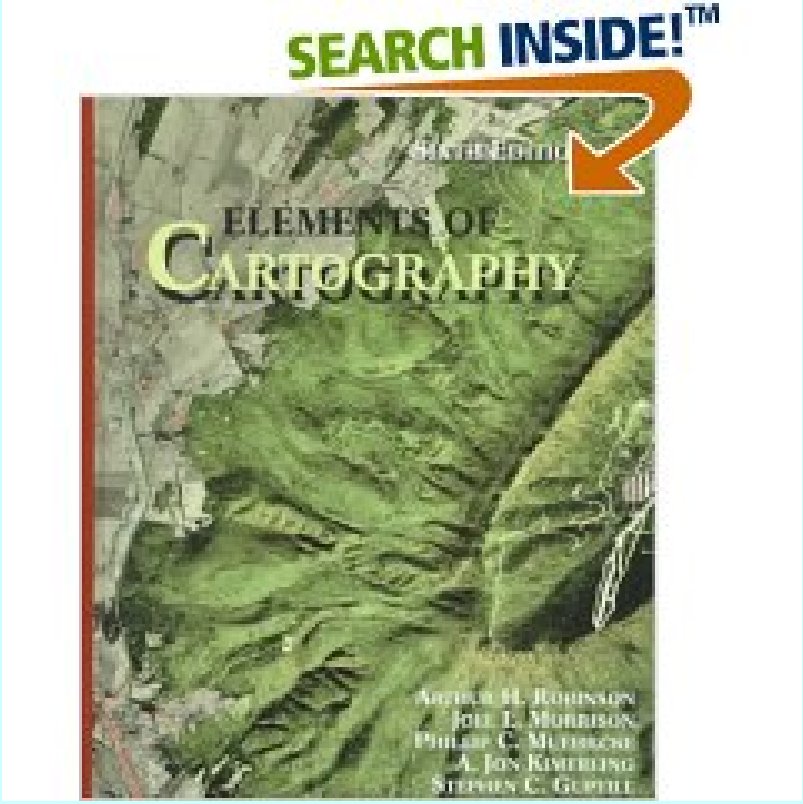
Geographic Information Systems and Global Positioning Systems (GPS) Training Opportunities

- HBCU Summer Faculty GIS Workshop – Contact: Ms. Pamela Bingham Environmentally1@aol.com
- Center for Spatially Integrated Social Science (www.csiss.org) – Contact: Dr. Don Janelle janelle@geog.ucsb.edu
- Environmental Systems Research Institute (ESRI) – (http://www.esri.com/training)

Cartography

- **In order to be an effective GIS user, one should complete at least one course in Cartography (the art and science of map-making).**

Recommended Cartography reference source – Elements of Cartography by Arthur H. Robinson et al. Publisher: John Wiley & Sons (1995)



GEOSPATIAL TECHNOLOGY

High Growth INDUSTRY PROFILE

Industry Snapshot

Growth Pattern

- The geospatial technology industry is defined as "an information technology field of practice that acquires, manages, interprets, integrates, displays, analyzes, or otherwise uses data focusing on the geographic, temporal, and spatial context." It also includes development and life-cycle management of information technology tools to support the above. *(Geospatial Workforce Development Center, University of Southern Mississippi)*

- The progressively complex and accelerating pace of change in the geospatial technology industry offers dramatic possibilities for meeting the increasingly sophisticated geospatial information demands of government, private industry, scientists, and the public. *(U.S. Geological Survey)*

Summer Workshops for Faculty - 2007

- **17-22 June 2007, The Ohio State University, Columbus, Ohio**
- **15-20 July 2007, University of California, Santa Barbara**
- **Applications may be submitted at www.csiss.org/SPACE - Deadline – April 13, 2007**

SPACE Spatial Perspectives on Analysis for Curriculum Enhancement

Scholarship Support

There are no fees required to participate in a SPACE workshop. Participants may apply for awards of up to a maximum of $1000. Participants from designated minority institutions in the United States, and participants of Hispanic American, African American, or Native American background may be eligible for additional scholarship support.

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