Applications of GIS and Spatial Analysis Tools in the Development of Demonstration Modules for an Urban Geography Course

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Nashville, Tennessee

Tennessee State University
Fall 1999

- Historically Black College – 8,000 students
- Offers only Geography minor –
  No students minor in Geography
- Geography courses primarily taught to fulfill pre-service teacher requirements
- No visible use of Geographic Information Systems in teaching or research

GIS Capacity Development at TSU Fall 1999-Summer 2000

- **USDA 1890 HBCU Capacity Building Grant** funds used to launch Geographic Information Sciences (GISc) Laboratory
- **NASA Center for Automated Space Sciences (CASS)** program funds become available to support several undergraduate student researchers and expand the GISc Lab.
- **GISc Lab** formally established during summer 2000 with seven undergraduate student researchers on staff.

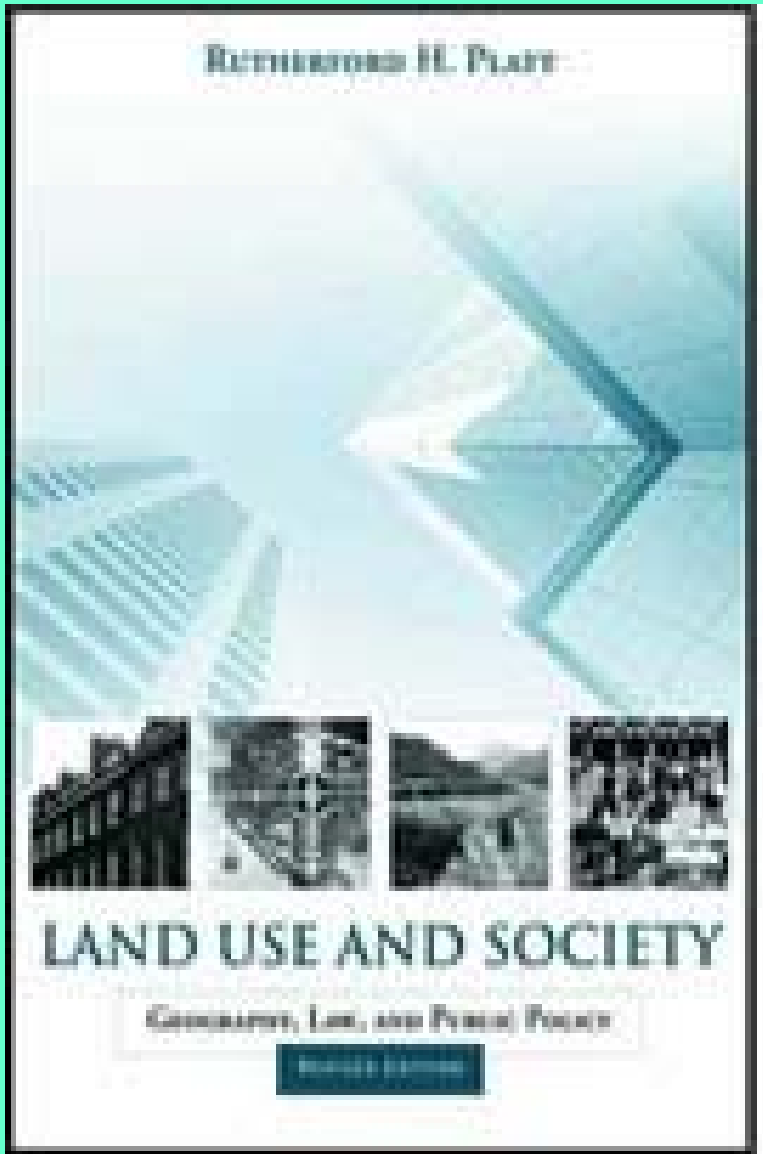
GISc Lab Urban/Environmental Studies Service Learning Development Fall 2001 - Present

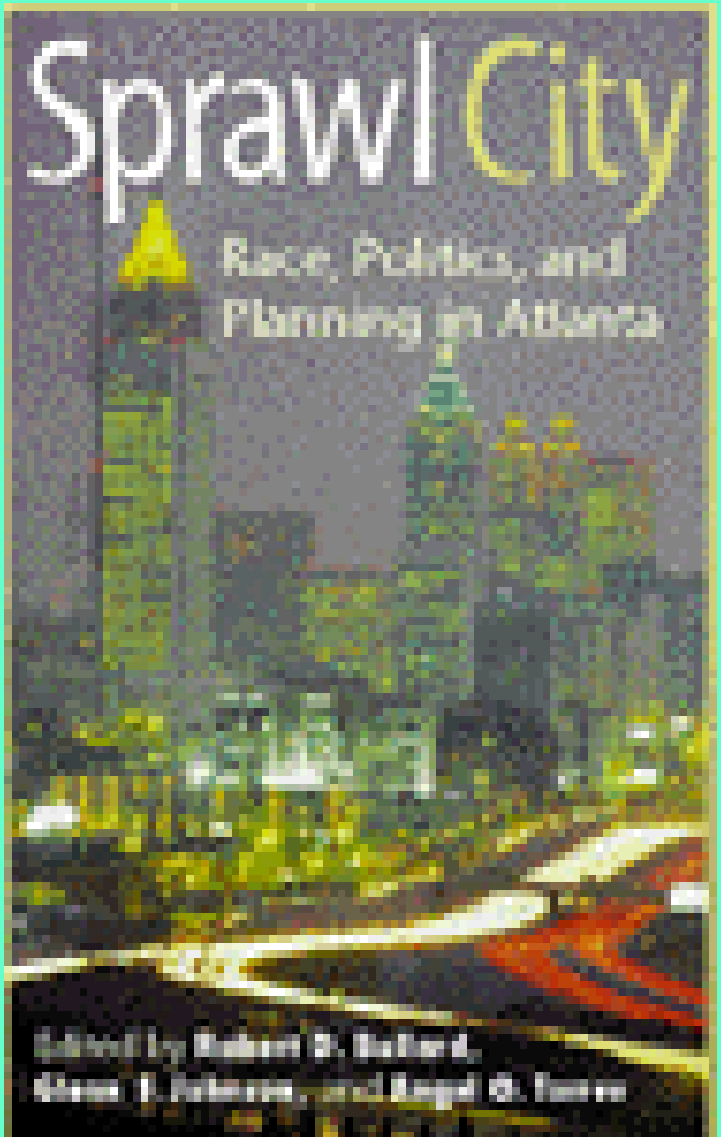
- **Massie Chair of Excellence in Environmental Science and NASA Center for Automated Space Sciences (CASS)** programs provide funding for GIS hardware and software and support for several undergraduate research assistants.
- **GLOBE program:** TSU becomes a partner institution with the support of the Center of Excellence in Information Systems. Several local k-12 teachers are certified in GLOBE environmental sampling protocols.
- **The GISc Lab** establishes informal working partnerships with Fisk University, Vanderbilt University, Meharry Medical College, the Mayor's Office of Neighborhoods, the Neighborhoods Resource Center, EarthMatters Tennessee, and the Community at Bordeaux.
- **GISc Lab** research assistants and students enrolled in Cartography (GEOG 310) and Urban Geography (GEOG 485) engage in GIS-based environmental/urban studies-based service learning projects…

TSU Upper Division Geography Courses with GIS and Spatial Analysis Content

- **Urban Geography (GEOG 4850) – Course content includes urban GIS applications. An "Urban GIS Term Paper" is required.**
- Cartography (GEOG 3100) – Course content updated with GIS-based material. Students are required to complete a "hands-on" GIS project.
- Physical Geography (GEOG 3010) – Course content includes GIS, GPS, and remote sensing applications.

Urban Geography (GEOG 4850)
Current Textbooks

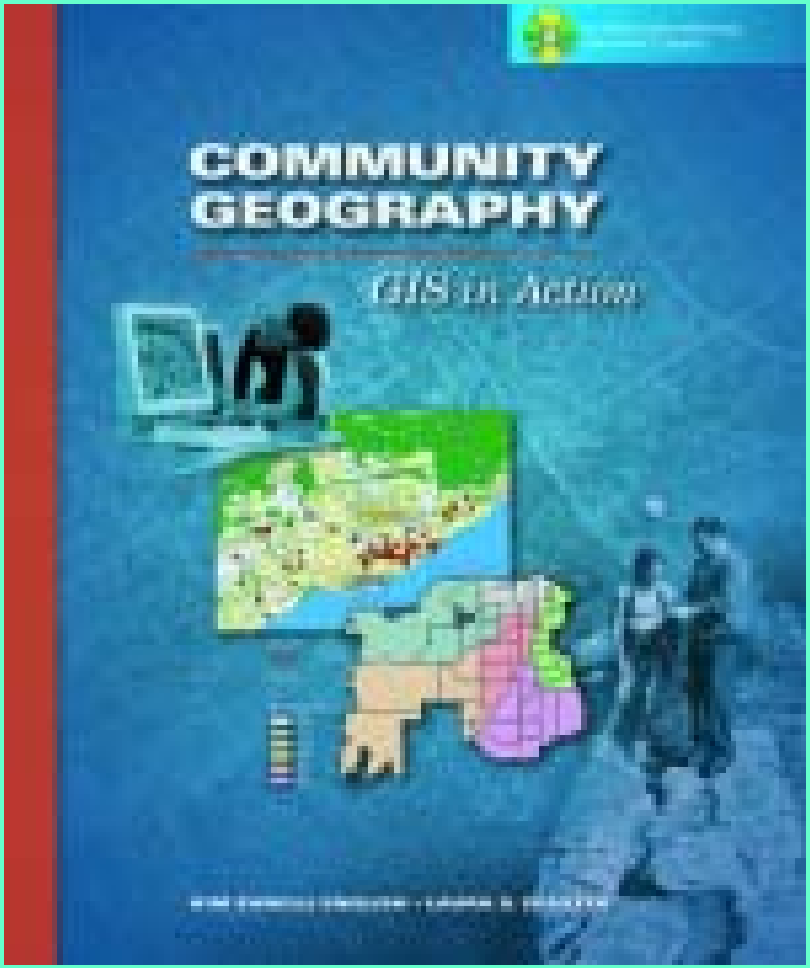


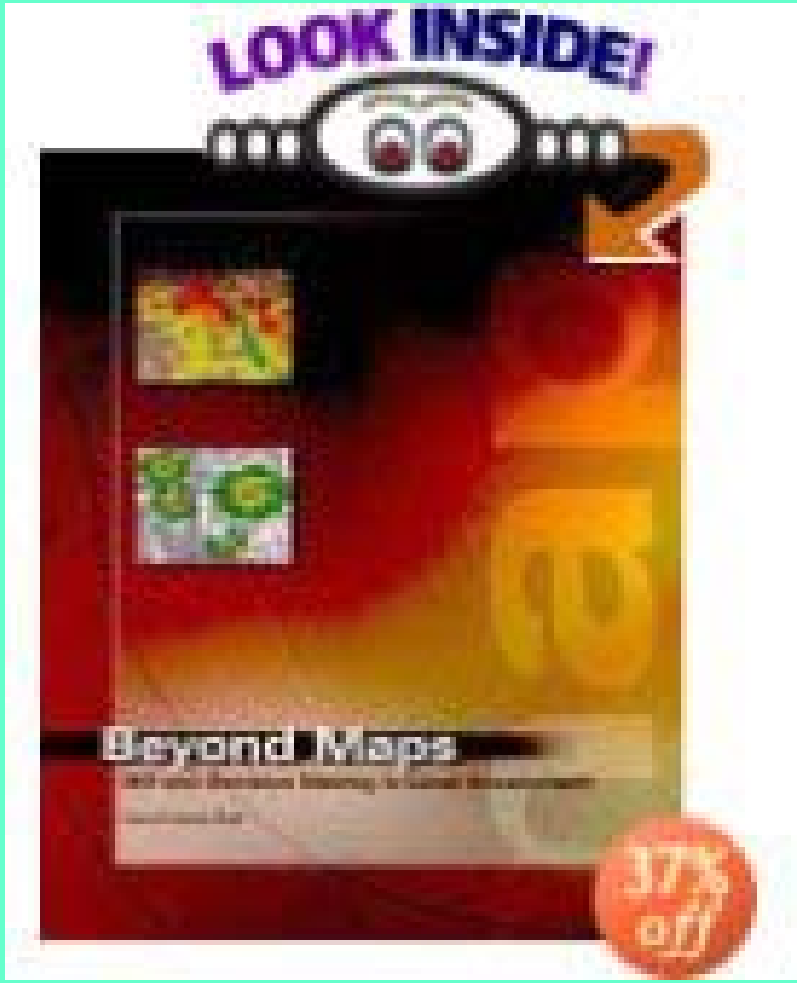


Need for Development of Demonstration Modules for Urban Geography (GEOG 4850)

- Most students enrolled are social sciences majors who have no background in Geography or Geographic Information Systems.
- The cost of additional texts may be a turn-off for students in an “elective” course.
- Due to students’ lack of background, no current GIS-based supplementary textbook has been effective to date.

Urban Geography (GEOG 4850)
Former Supplementary GIS-based Texts





Classifications and Majors of Students Currently Enrolled in Urban Geography (GEOG 4850) for Spring 2005

Senior	Arts and Sciences
Senior	History
Sophomore	Business Administration
Senior	Arts and Sciences
Senior	Political Science
Senior	History
Senior	English
Senior	Undecided Undergrad
Junior	Business Administration
Sophomore	Biology

Student Term Paper Topics in Urban Geography (GEOG 4850) – Spring 2005.

- GIS Mapping of Grocery Store Audits vs Local Demographic and Socioeconomic Data
- Distribution of AIDS Cases in Washington, DC
- Impact of a Wal-Mart upon a Smyrna, Tennessee Community
- Spatial Analysis of Three Communities' Efforts to Keep Wal-Mart out of their Neighborhoods
- Spatial Comparison of the Location of Check-Cashing Businesses vs. Full-Service Banks

Student Term Paper Topics in Urban Geography (GEOG 4850) – Spring 2005 (continued).

- Spatial Location of Abortion Clinics vs Organizations Providing Alternatives to Abortion
- Should Nashville Invest in Expanding its Convention Center?
- Analysis of Land Uses Along a Planned Rev. Dr. Martin Luther King Boulevard Route.
- GPS and GIS Applications in the Development of a Black History/Urban Forestry Educational Walking Trail
- Population Changes Among Immigrant Residents: Nashville, Tennessee 1990-2000

GIS and Other Spatial Tools in the Analysis and Delineation of "Urban Food Deserts"

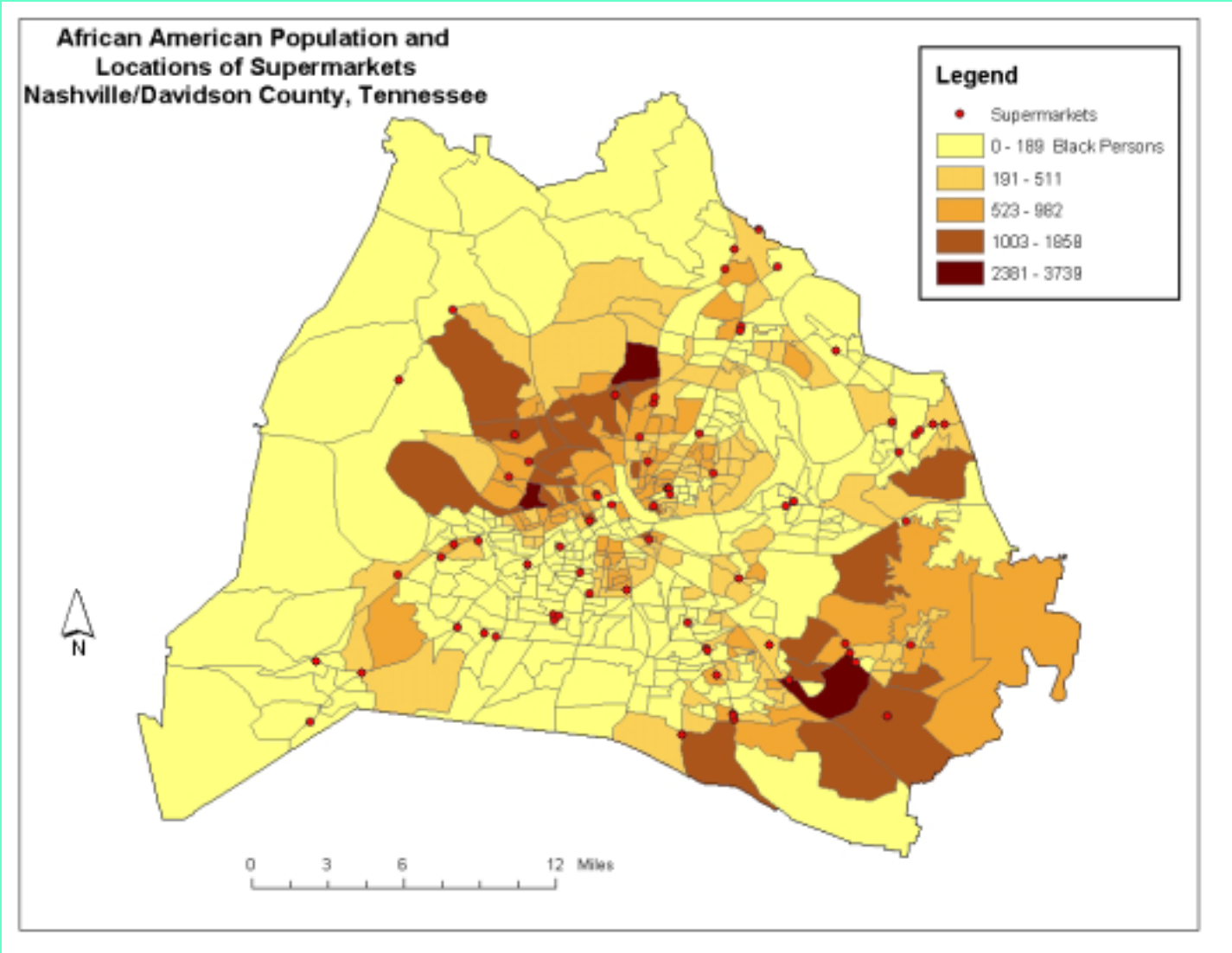
Student's Major: History – Classification: Senior

RESEARCH AND PRACTICE

The Contextual Effect of the Local Food Environment on Residents' Diets: The Atherosclerosis Risk in Communities Study

Kimberly Morland, PhD, Steve Wing, PhD, and Ana Diez Roux, MD, PhD

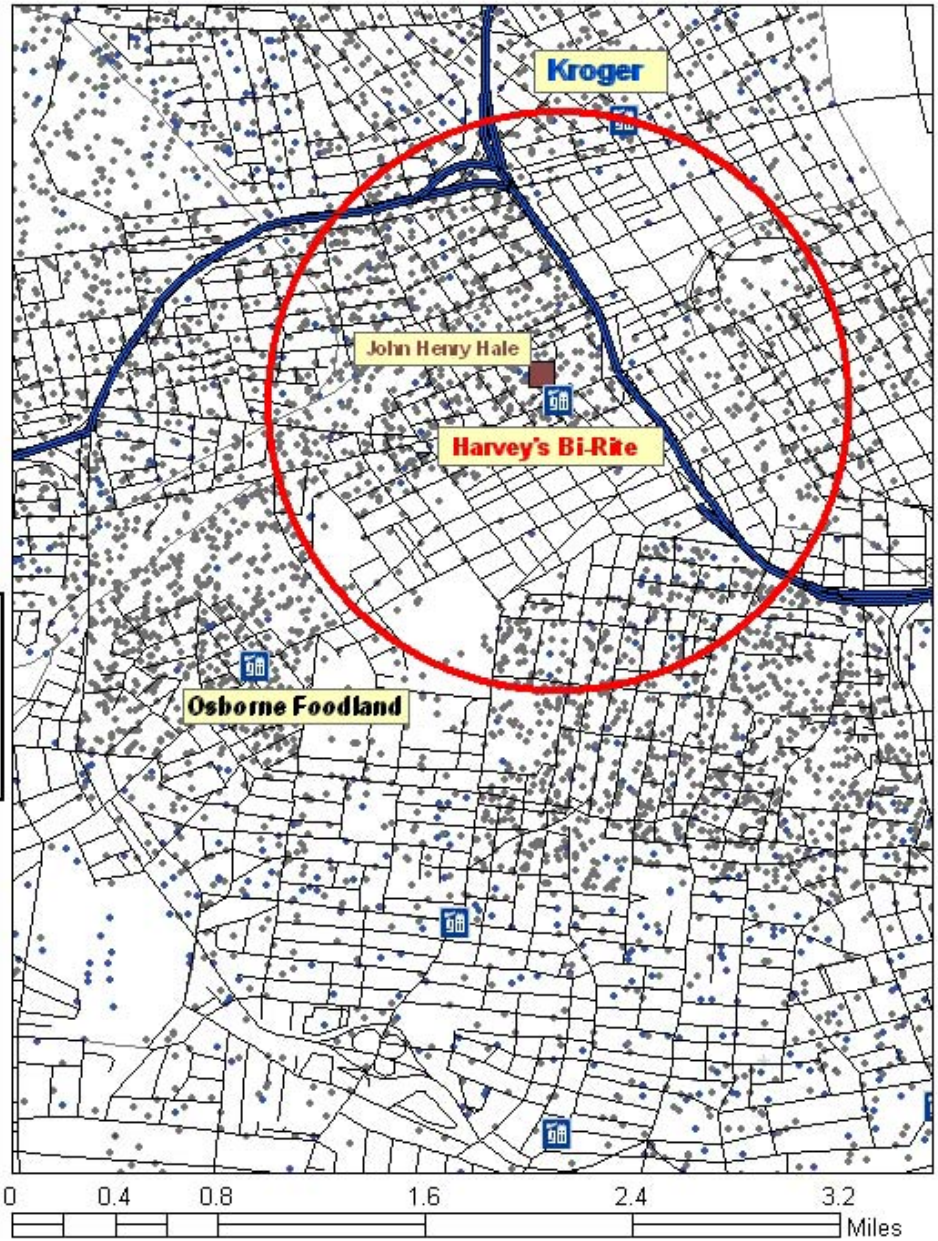
American Journal of Public Health - November 2002, Vol 92, No. 11



Map created using ArcGIS. Shapefile of grocery stores geocoded from data obtained from Nashville's Metro Health Department. Census Block Group data obtained from www.esri.com and www.census.gov (American Factfinder).

East Charlotte Avenue "Food Desert"

Nashville/Davidson County, Tennesee



Legend

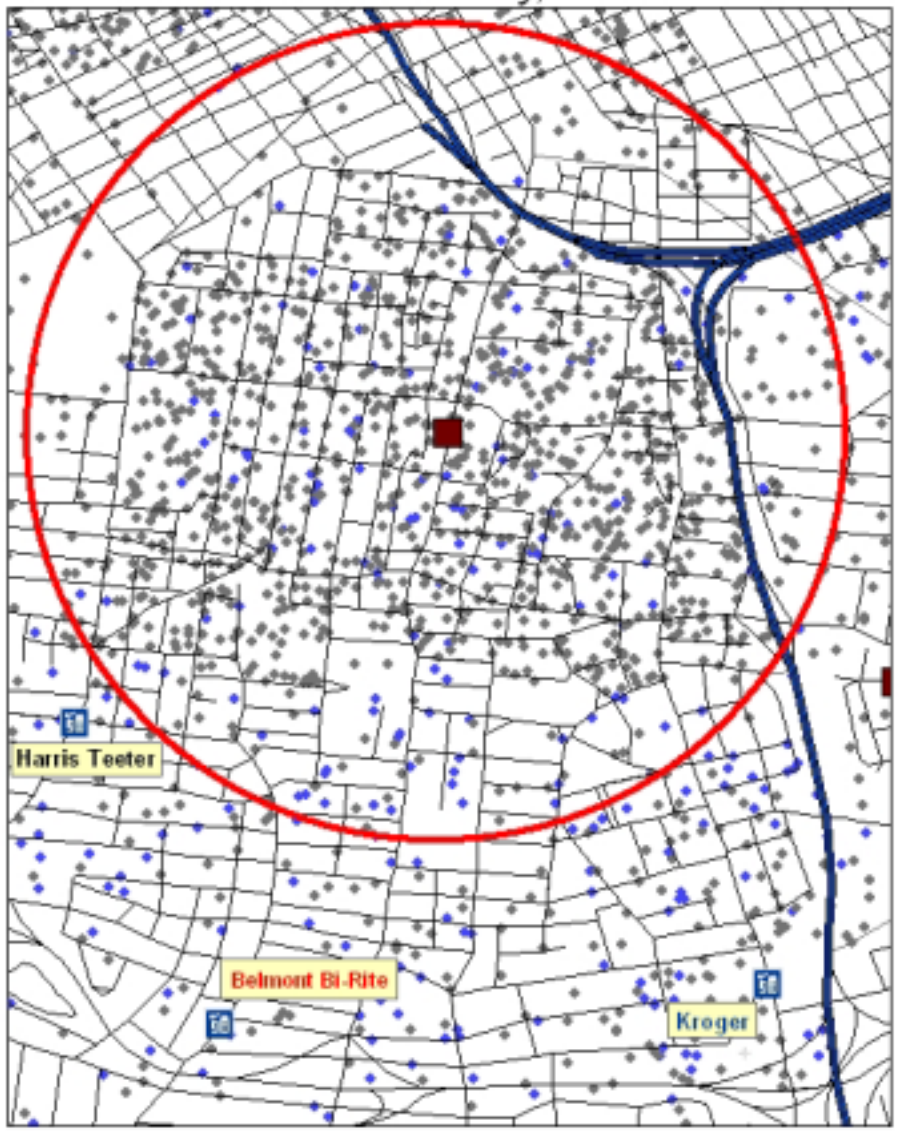
- Street Grid
- Interstate 40/65
- Grocery Stores
- Public Housing
- Street Grid
- 1 Dot = 1
- Renters With No Cars
- 1 Dot = 1
- Owners With No Cars

Circle represents a one mile radius around John Henry Hale Homes. Note that Harvey's Bi-Rite is only a corner market. Also note that the community's access to Kroger is cut off by Interstate highways.

TSU GISc Lab
October 2004

Edgehill "Food Desert"

Nashville/Davidson County, Tennesee



Circle represents a radius of approximately 1 mile around the Edghill Homes public housing complex

TSU GISc Lab
October 2004

Legend

- Interstate 40/65
- Grocery Stores
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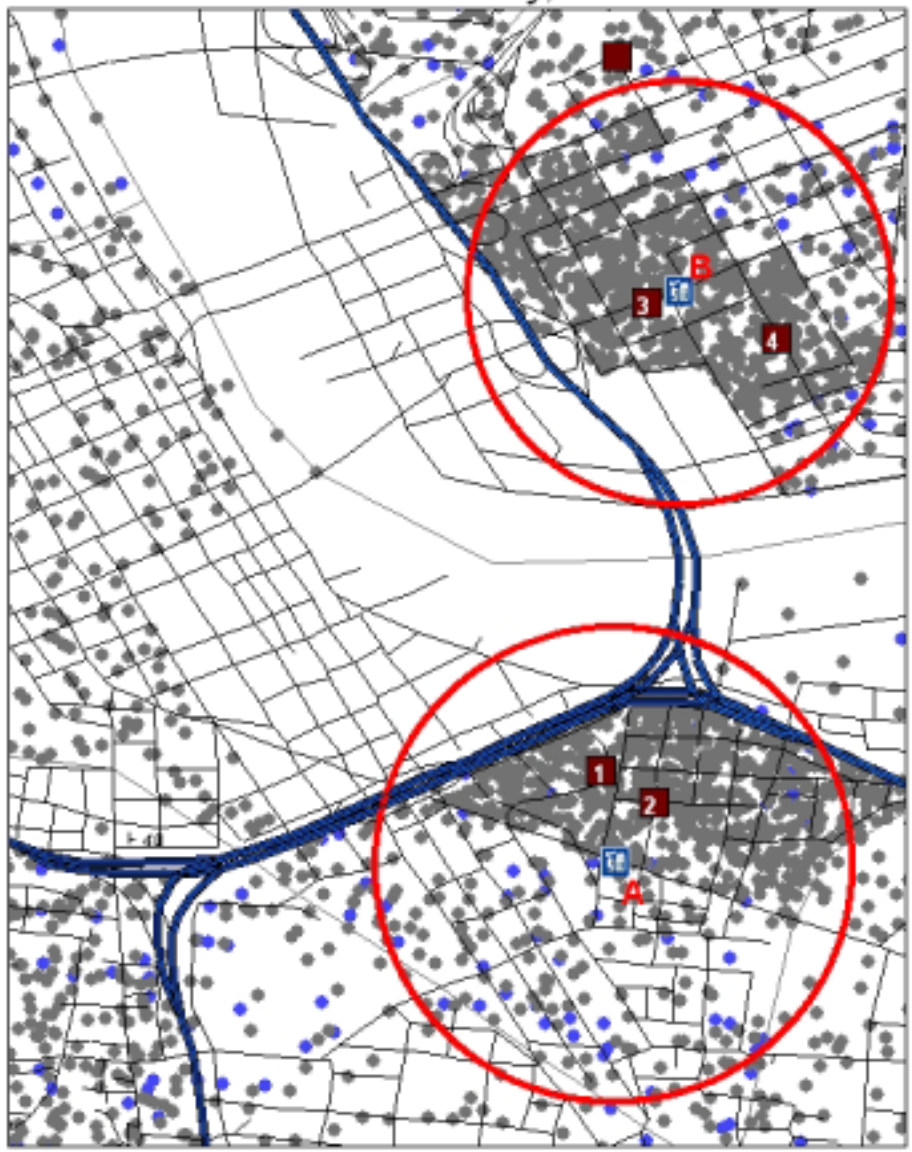
- Owners With No Cars
- Edgehill Homes

0 0.25 0.5 1 1.5 2 Miles

"Captive" Grocery Store Clientelle

Nashville/Davidson County, Tennesee



Each circle represents about a half-mile radius around grocery stores available to non-vehicle owning households. Residents essentially have only one option for food purchases.

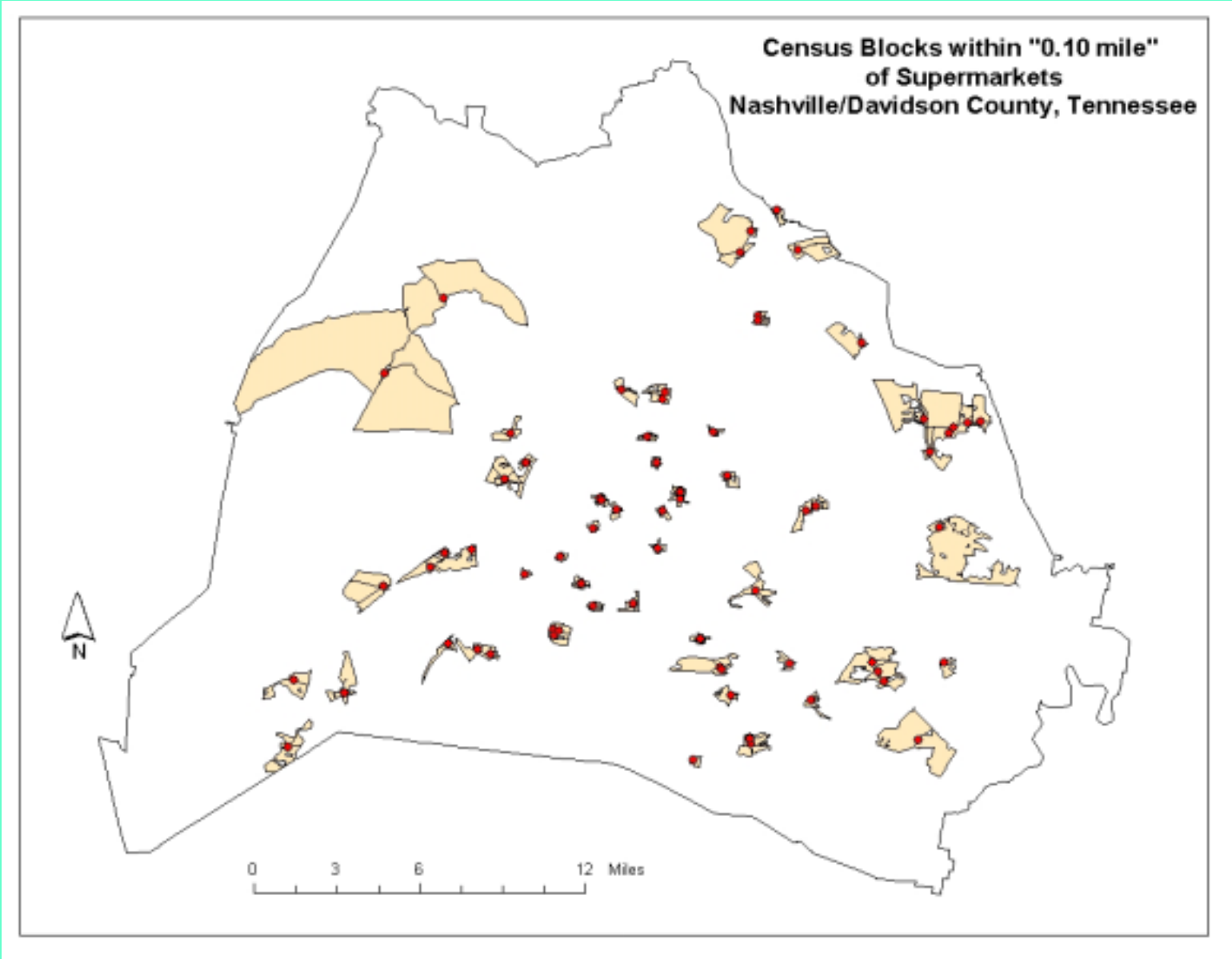
TSU GISc Lab
October 2004

Legend

- Interstate 24/40/65
- Grocery Stores
- Street Grid
- 1 Dot = 1
- Renters With No Cars
- 1 Dot = 1
- Owners With No Cars
- Public Housing
- Interstate 24

Public Housing
1 = Tony Sudekum Homes
2 = J.C. Napier Homes
3 = Edgefield Manor
4 = James A. Cayce Homes

A = Eddie's Cee Bee Market
B = Piggly Wiggly



Map creating using ArcGIS. Blocks within a “0.10 mile buffer” around the supermarket point file were selected.

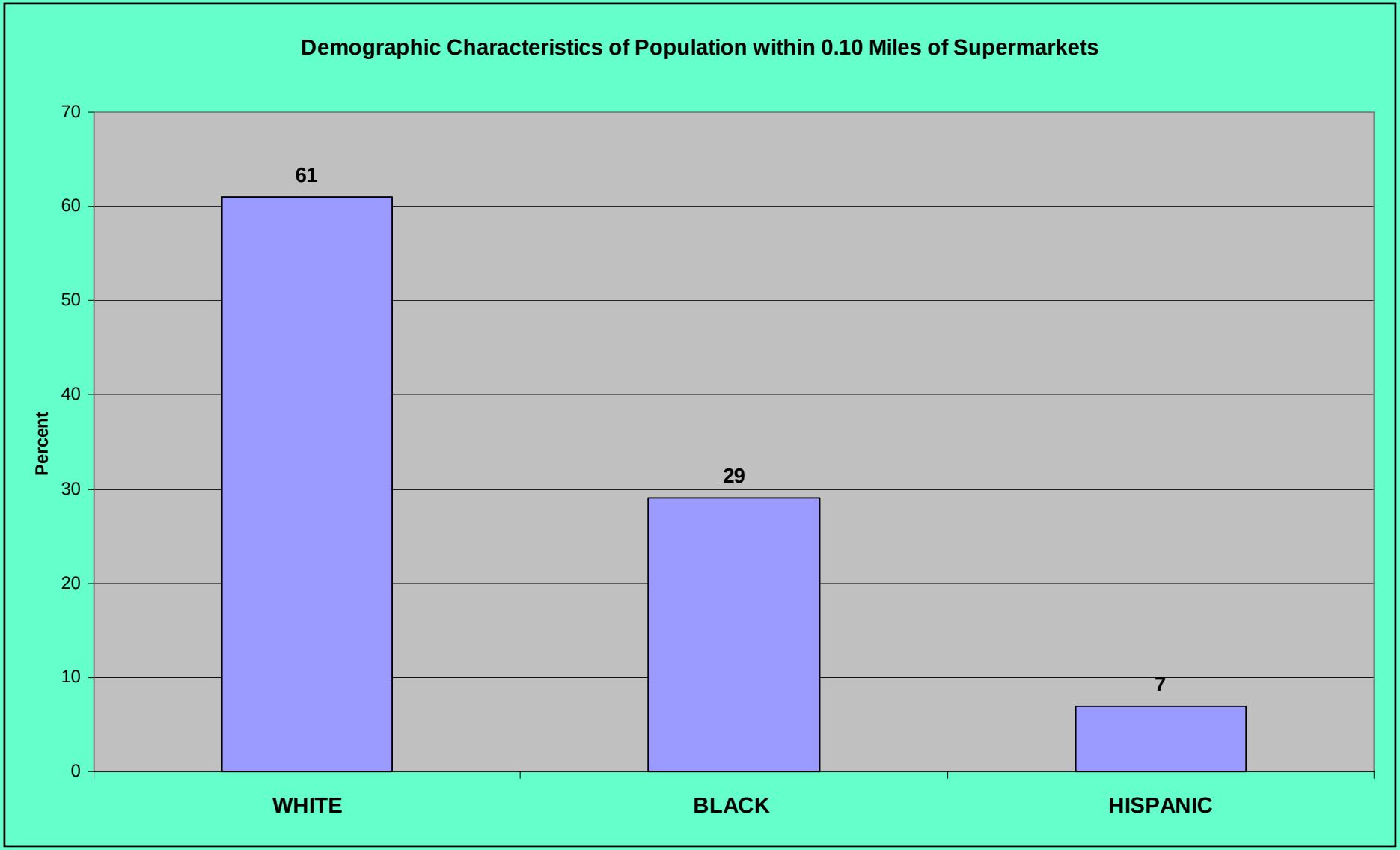
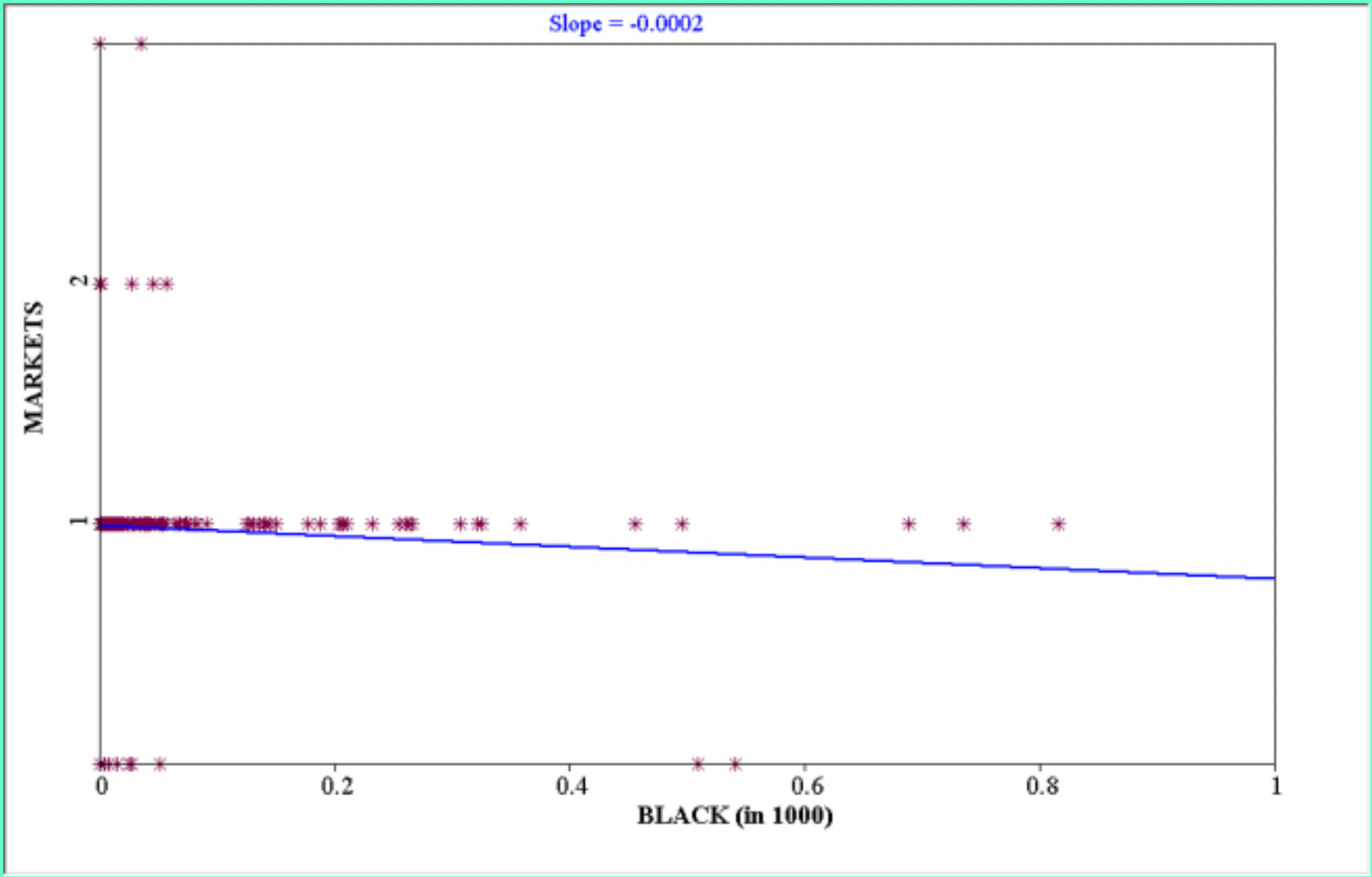
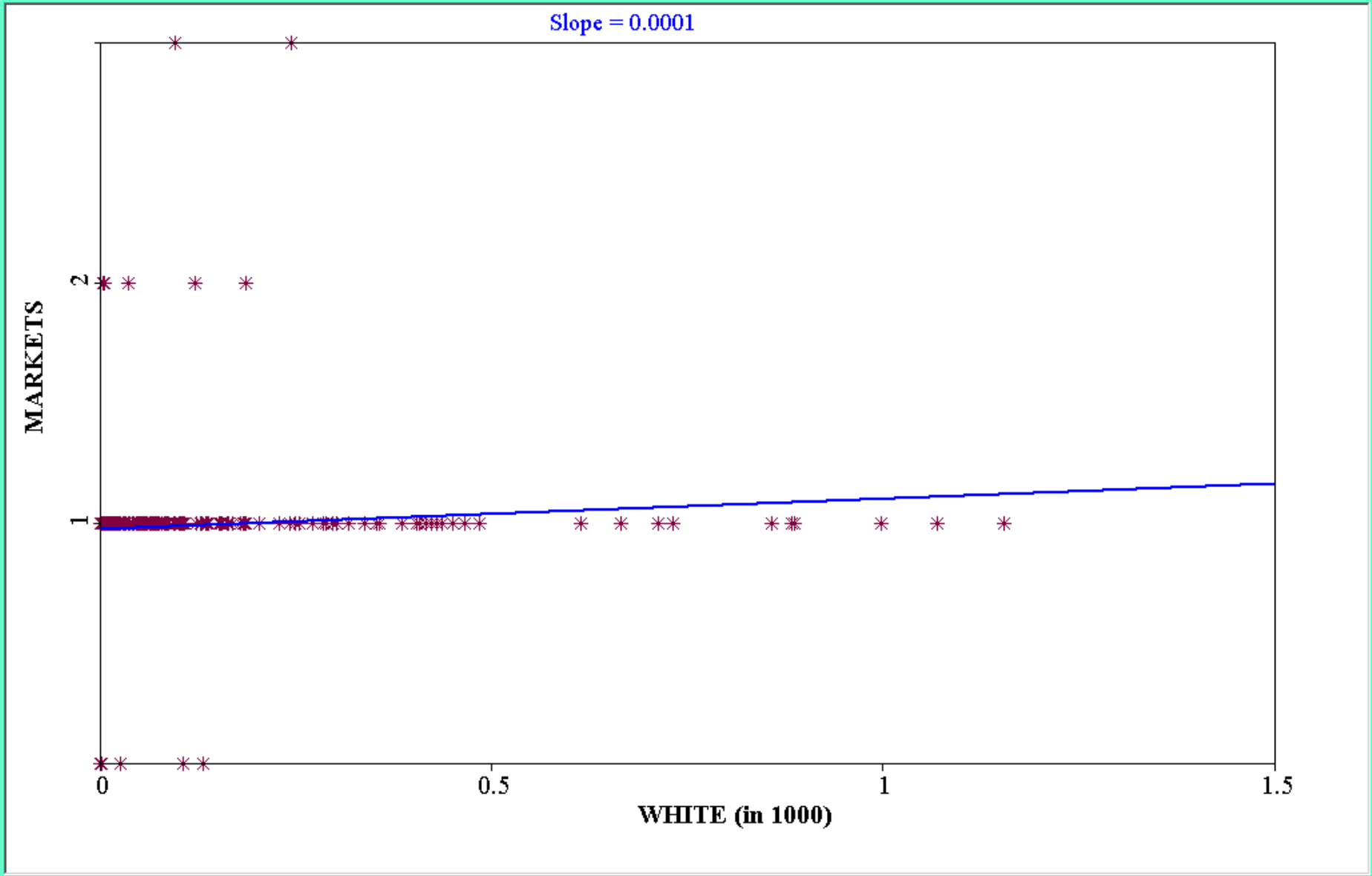


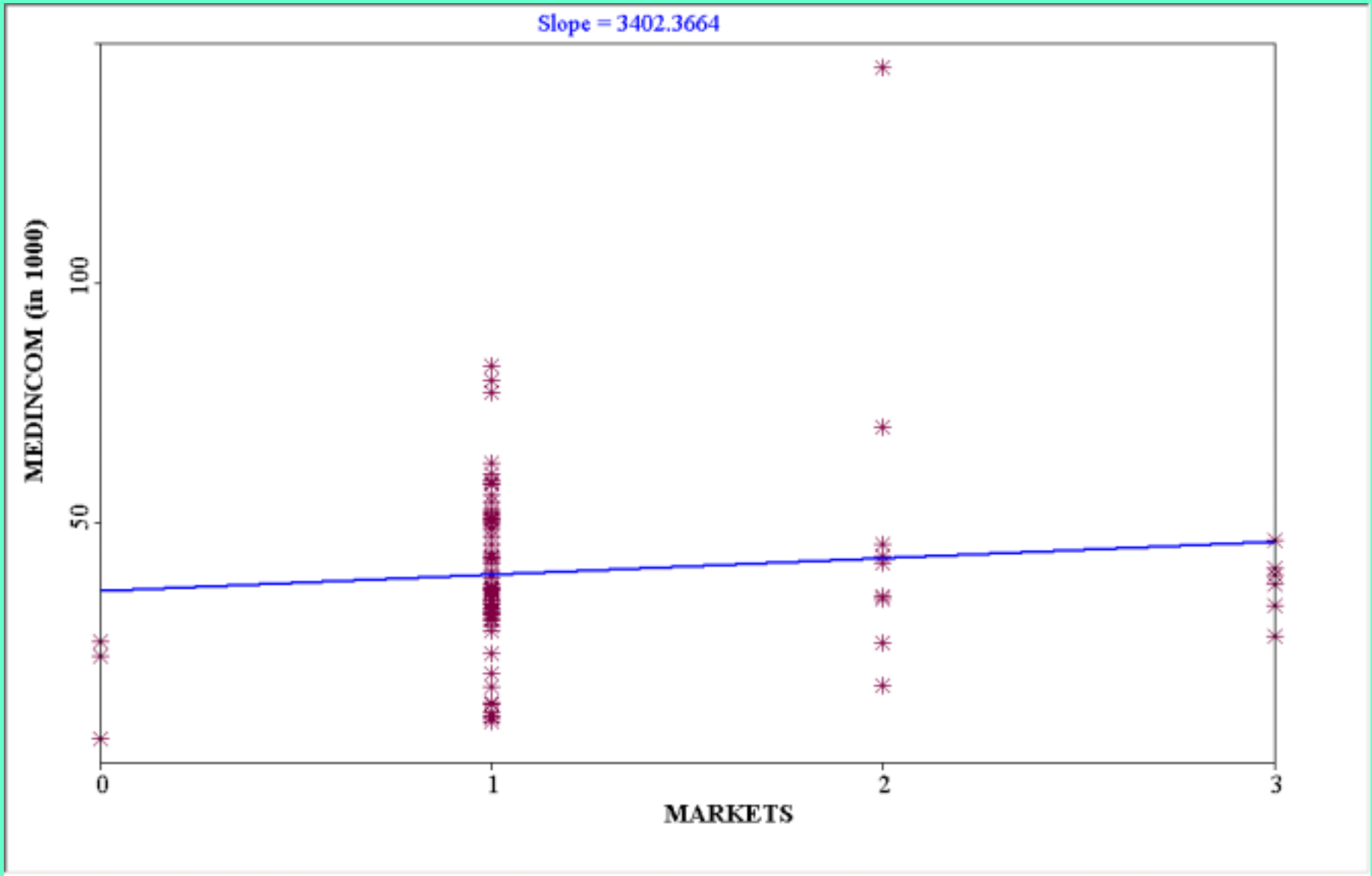
Chart derived using data downloaded from the attribute table for the selected Blocks within 0.10 mile of supermarkets.



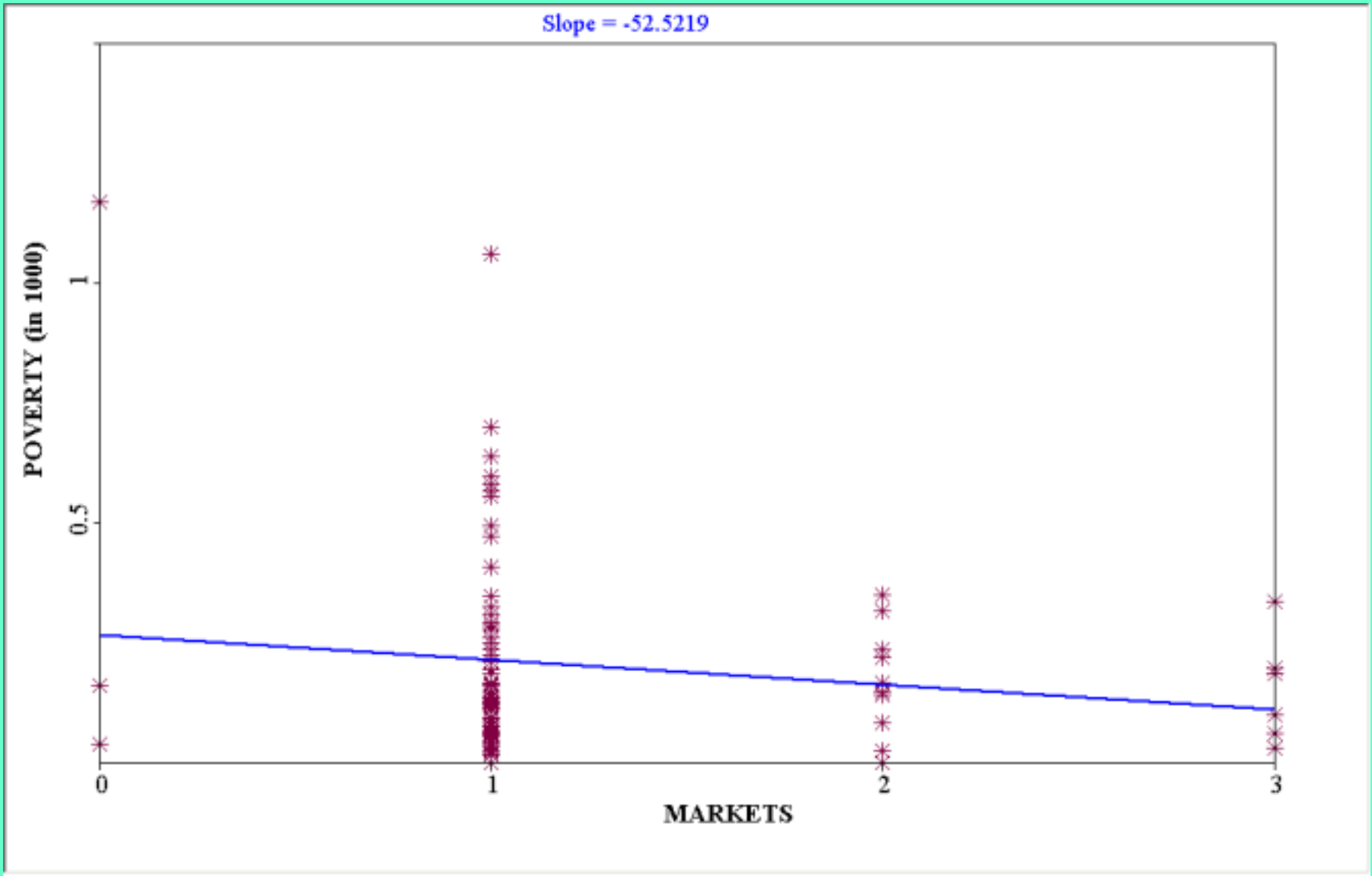
Scatter Graph created using GeoDa: Black population versus numbers of supermarkets per Census Block.



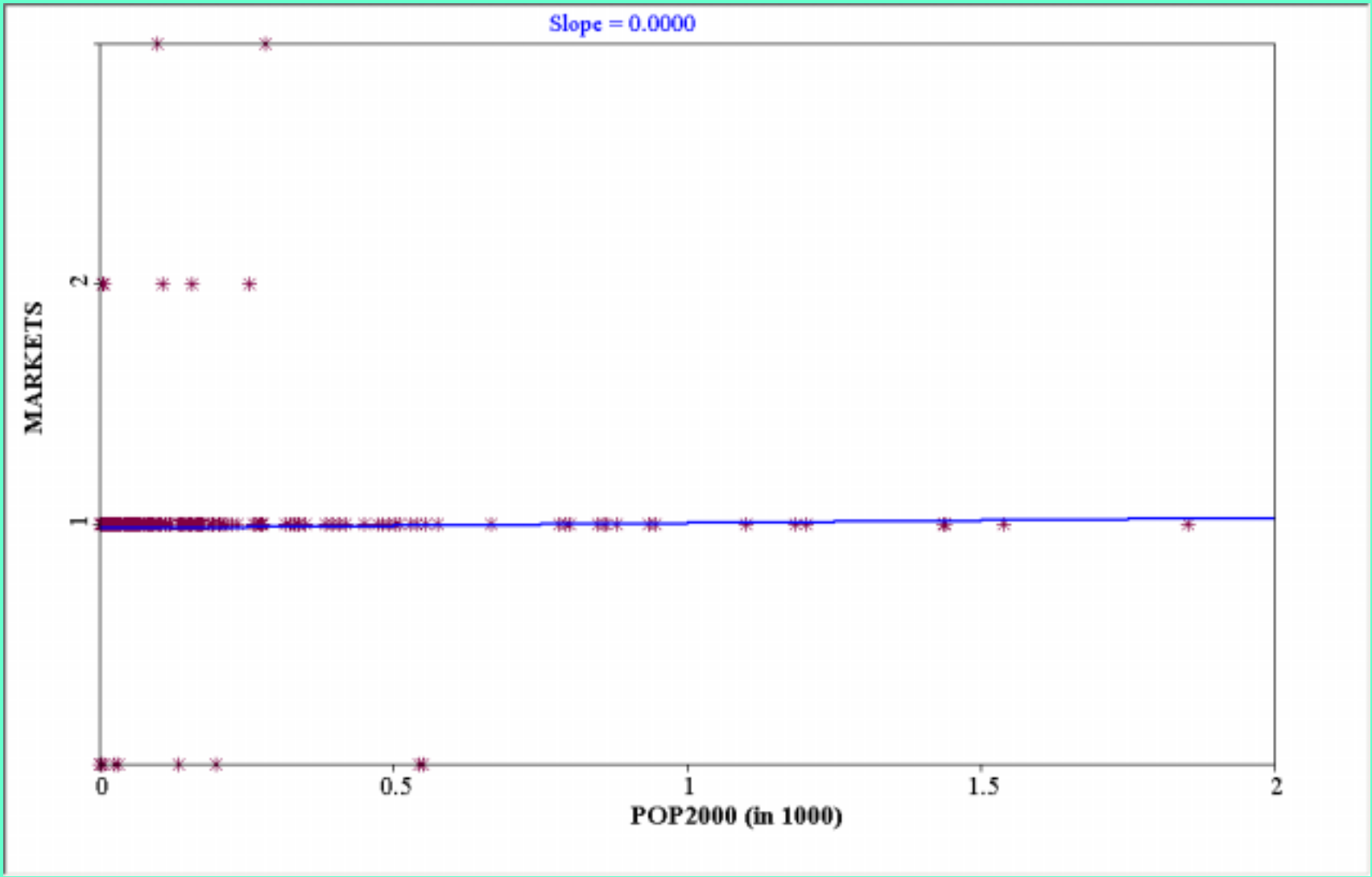
White population versus supermarkets per Census Block in Nashville.
Created with GeoDa



Median Income versus number of supermarkets per Census Block Group. Created with GeoDa.



Numbers of people living below the poverty level versus numbers of supermarkets per Census Block Group. Created with GeoDa.



Total population versus number of supermarkets per Census Block Group. Created using GeoDa.

Future Food Desert Research Initiatives in Nashville

- The TSU GISc Lab will continue to work with Tying Nashville Together; grocery store audit data will be added to map attribute data for further analysis.
- The partnership with the Vanderbilt Community Outreach Partnership Center (COPC) will continue with efforts focused upon bringing a major chain grocery store to North Nashville.

Assessing the Impacts of Greenspace Deficits Upon Racial Health Disparities in Nashville, Tennessee

Student's Major: English – Classification: Senior

From: Nashville Metro Parks Master Plan

November 2002

Assessing the Impacts of Greenspace Deficits Upon Racial Health Disparities in Nashville, Tennessee

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Assessing the Impacts of Greenspace Deficits Upon Racial Health Disparities in Nashville, Tennessee

- Are the racial health disparities present in Nashville associated with lack of physical activity?
- Is the lack of physical activity among African Americans in Nashville associated with urban design factors?
- If provided urban space more conducive to physical activity, would North Nashville's African American population become more physically active?

- 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

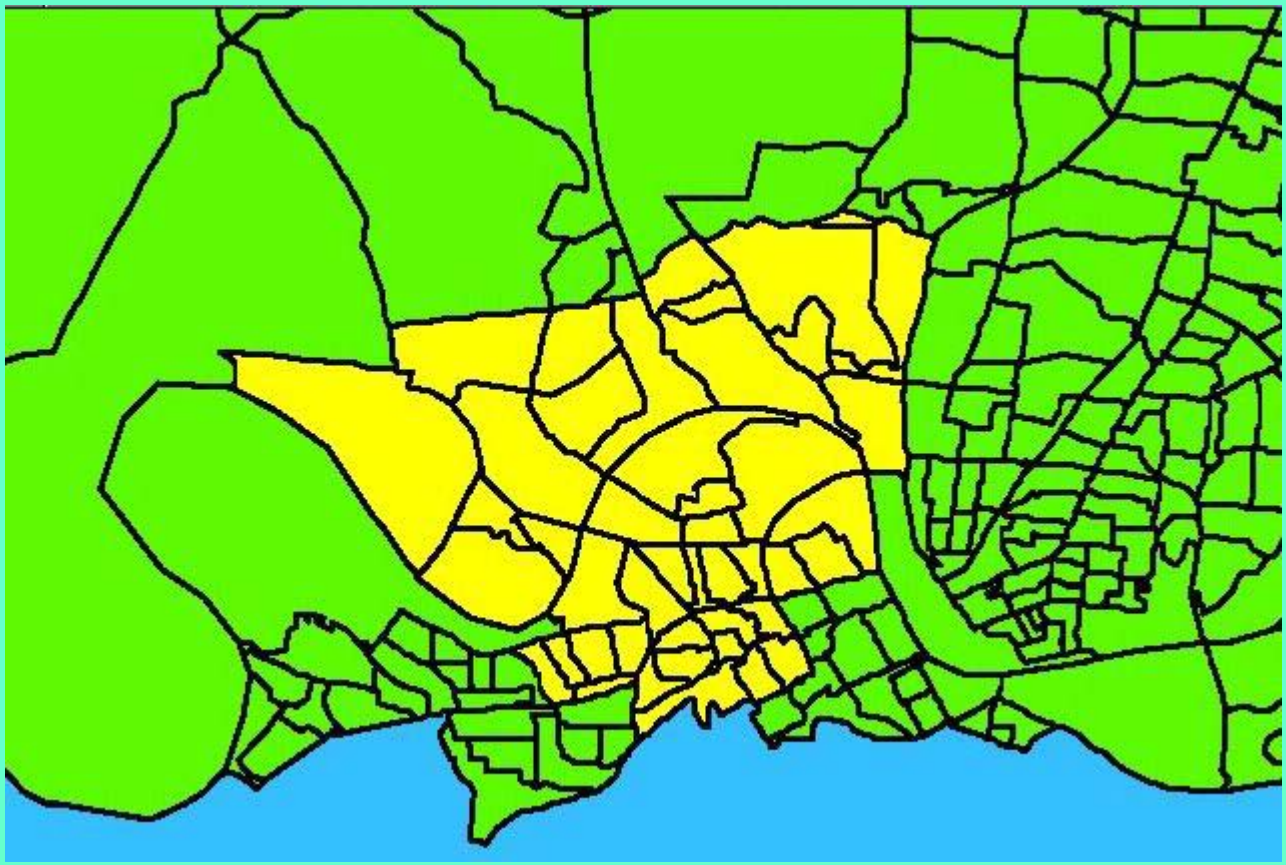
Ethnic

Approaches to

Community

Health

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



Census tracts comprising REACH study area.

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- 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)

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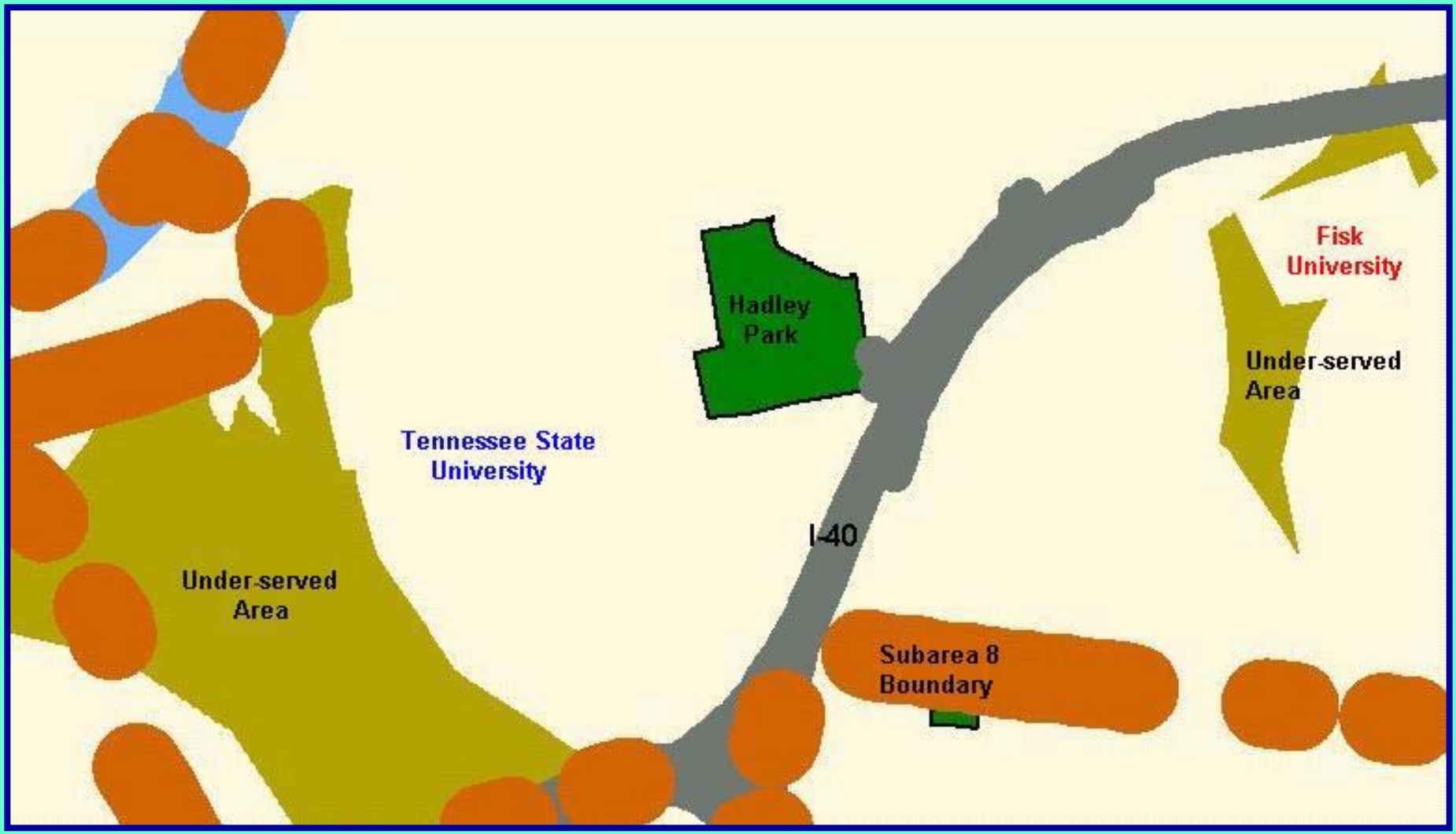
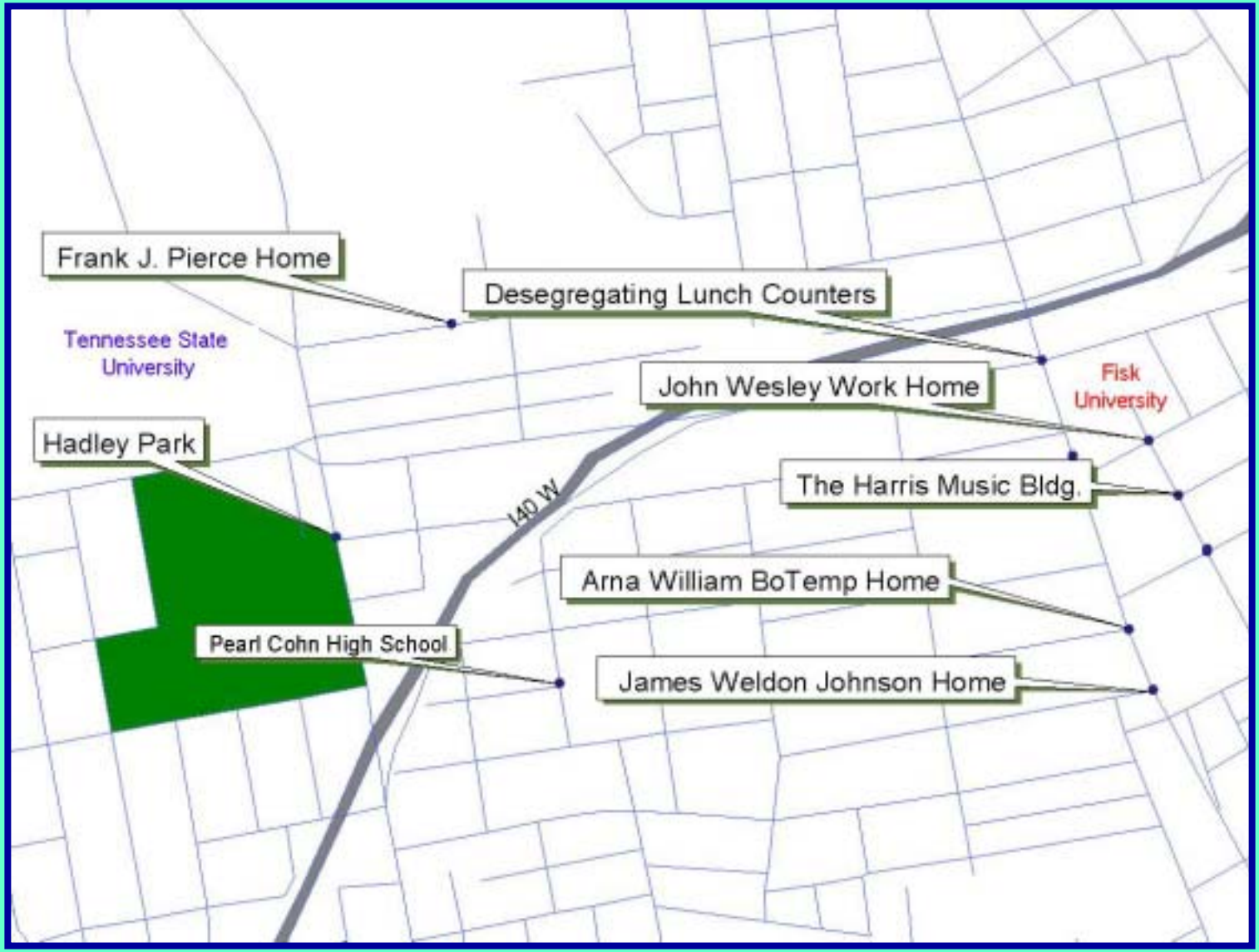
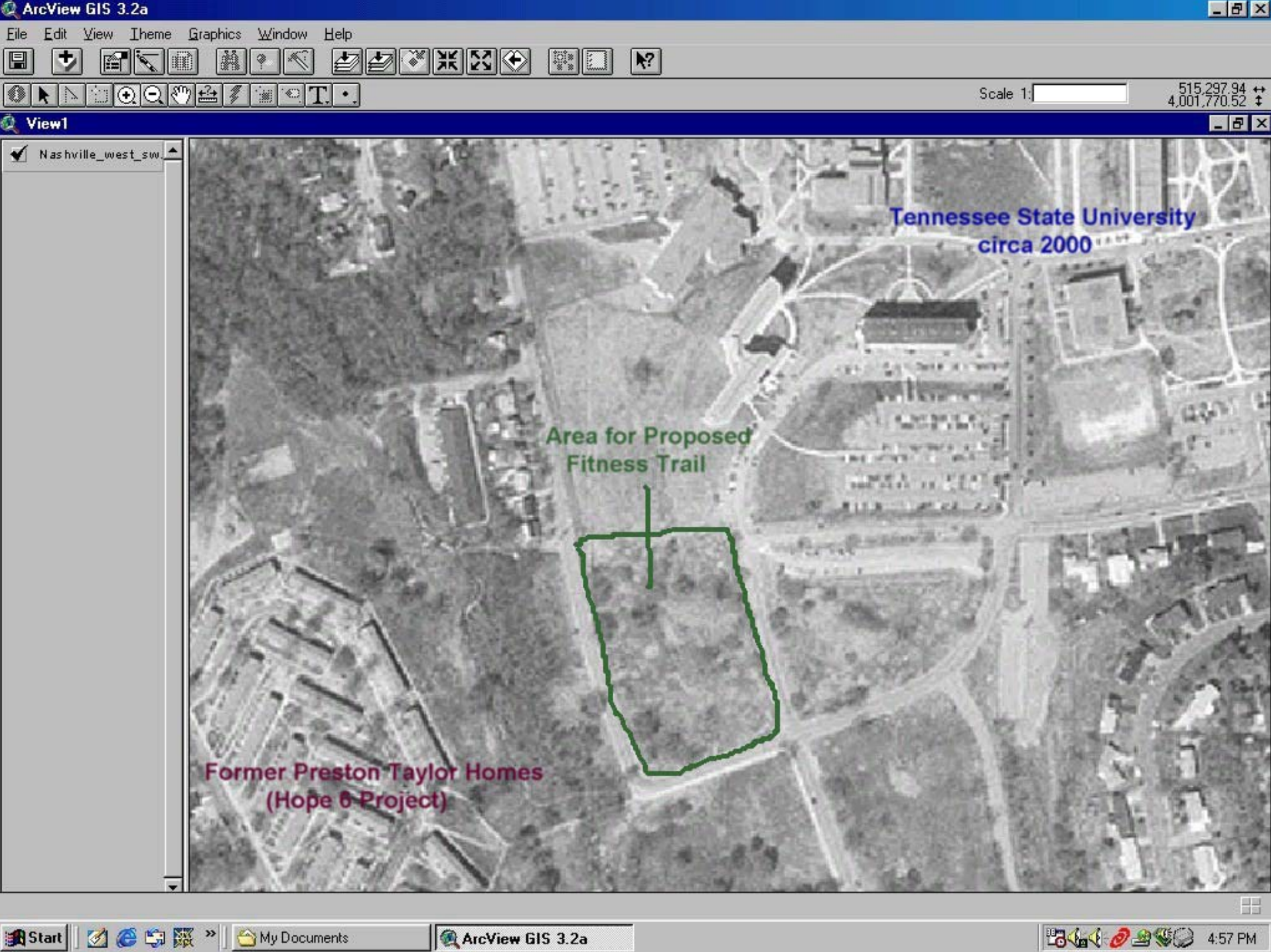
- African American females had the highest percentage (82%) “at risk due to inadequate exercise” among the racial-gender groups surveyed.
- African American females had the lowest percentage (69%) who had exercised in the past 30 days among the racial-gender groups surveyed.
- African American females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



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)

“North Nashville History and Urban Forestry Educational Fitness Trail” - Proposed urban design model to encourage physical activity among North Nashville residents.

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Tennessee State University
circa 2000
Area for Proposed
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Former Preston Taylor Homes
(Hope 6 Project)
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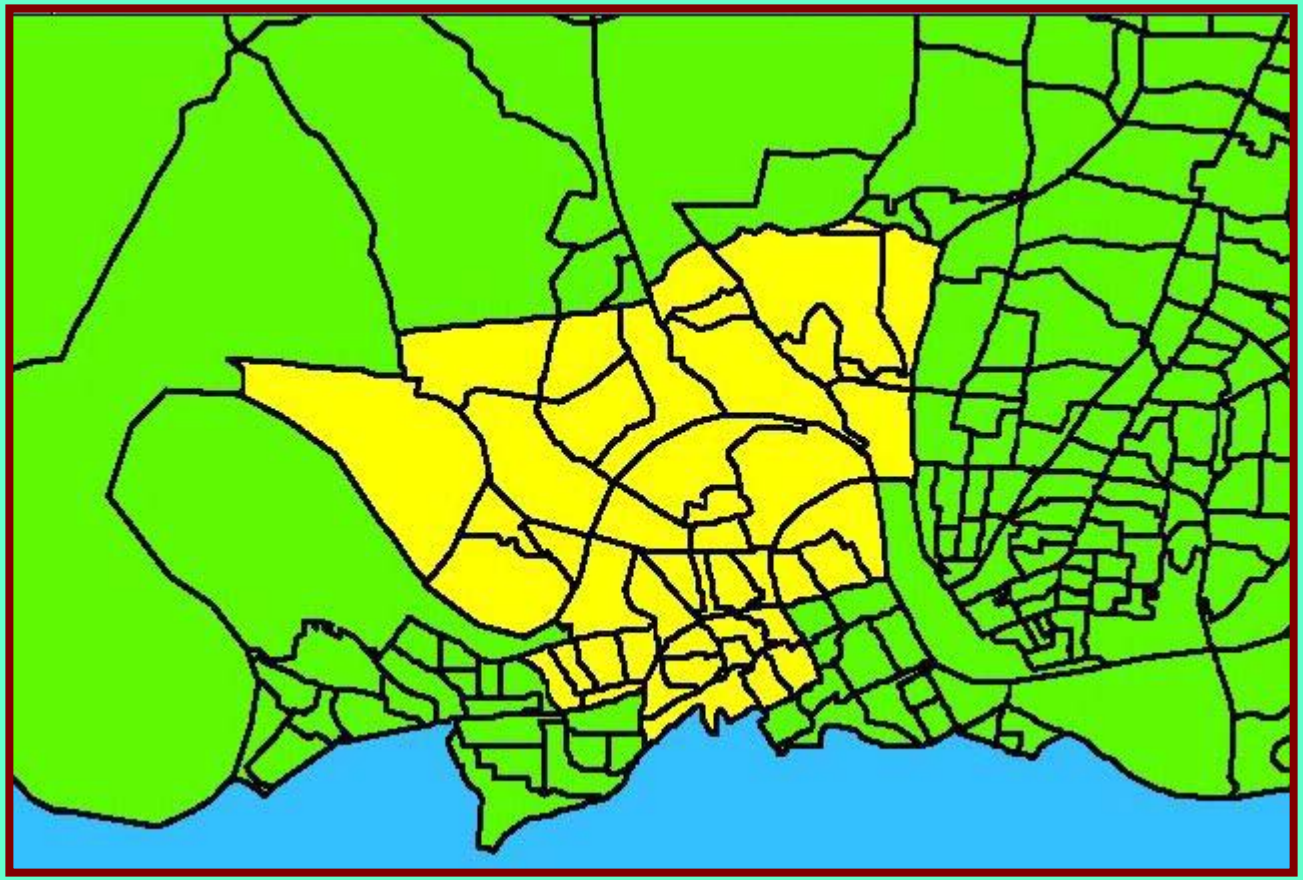
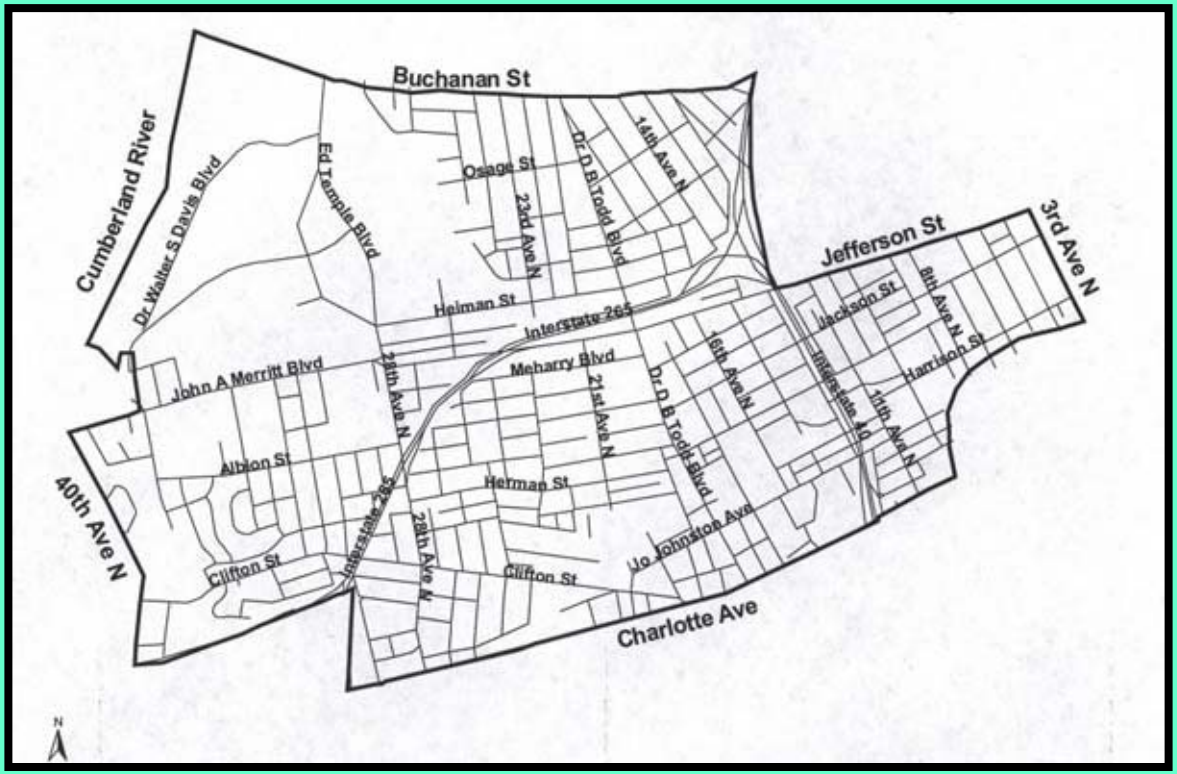
Defining Study Area Geography for Community Survey



“North Nashville” as defined by the REACH project.

Defining Study Area Geography for Community Survey



“North Nashville” as defined by the North Nashville Community Development Corporation.

Defining Study Area Geography for Community Survey

“North Nashville” as defined by Nashville Metro Government.

Long Term Goals

- Survey results indicate that the proposed historic walking path and fitness trail will significantly increase physical activity among North Nashville residents.
- Upon acknowledging that urban design change will potentially reduce racial health disparities, Metro government funds the project in cooperation with TSU.
- Upon completion, the facility serves as a vehicle for further research on relationships between physical activity and urban design.

Sample Content for Demonstration Module Developed with GIS and FlowMapper at the 2004 SPACE Summer Workshop:

"Impacts of Urban Sprawl Upon African Americans' Quality of Life In Nashville and Environs"

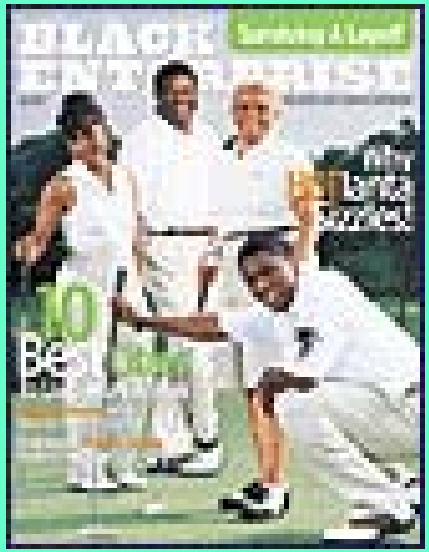
Spatial Perspectives on Analysis for Curriculum Enhancement

EVIDENCE OF URBAN SPRAWL IN THE NASHVILLE MSA 1980-2000

Recent studies conducted by USA Today (El Nasser and Overburg, 2001) and the Brookings Institute (Fulton et al, 2001) have identified Nashville as one of the fastest growing urban regions in the United States.

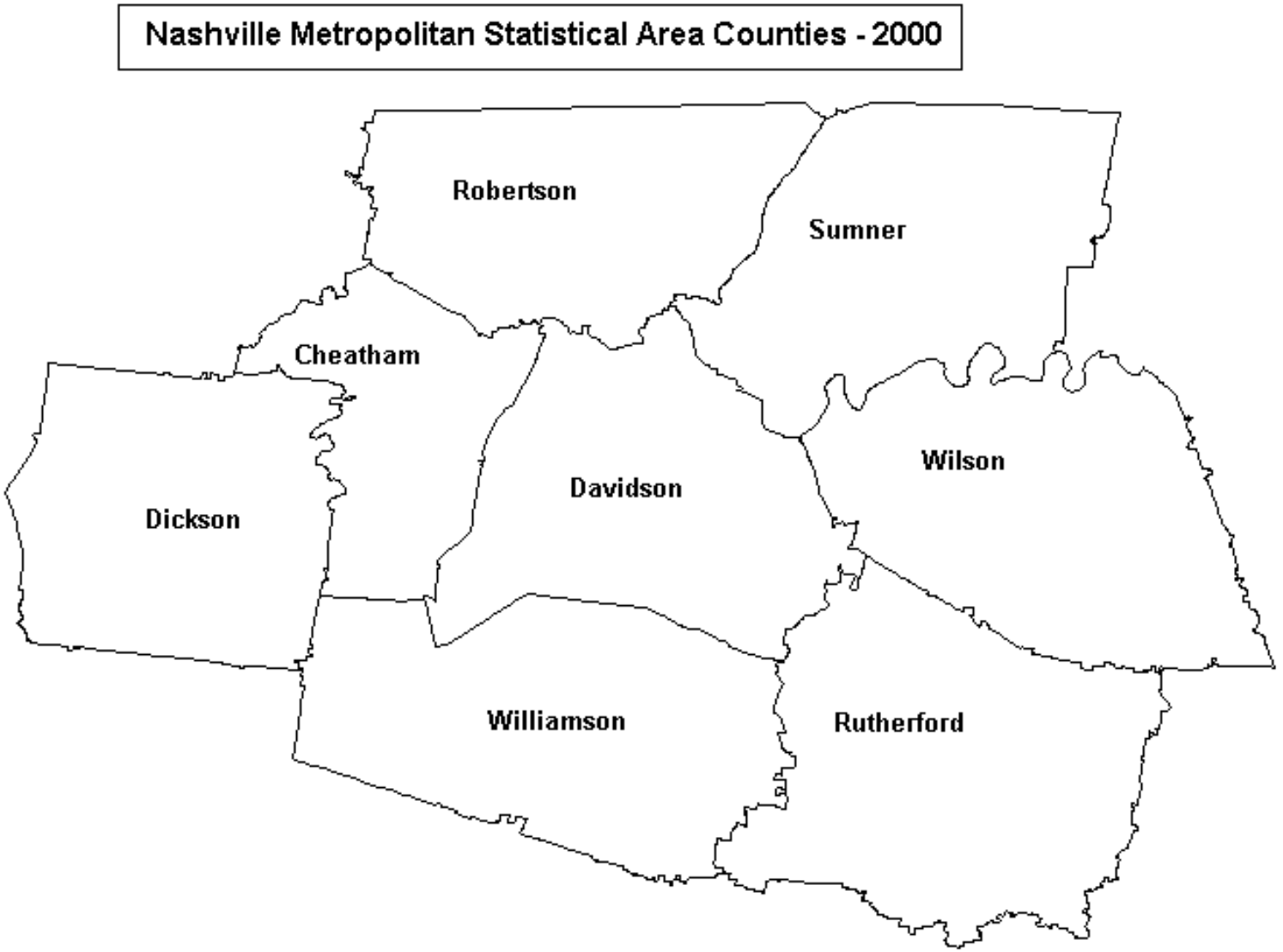
Census estimates put the 1997 population at 1,134,524, an increase of over 280,000 since 1980. The MA grew at a rate of 15.8 percent between 1980 and 1990, and continued at a 15.2 percent rate from 1990 to 1997 (U.S. Department of Commerce, 1998).

Several counties within the MA are expected to grow at exceptionally rapid rates between the years 2000 and 2020: Cheatham (63.9 percent), Williamson (57.8 percent), Rutherford (53.5 percent), Dickson (46.9 percent), Wilson (45.2 percent), Sumner (43.6 percent), and Robertson (34.2 percent) (Center for Business and Economic Research, 1999).

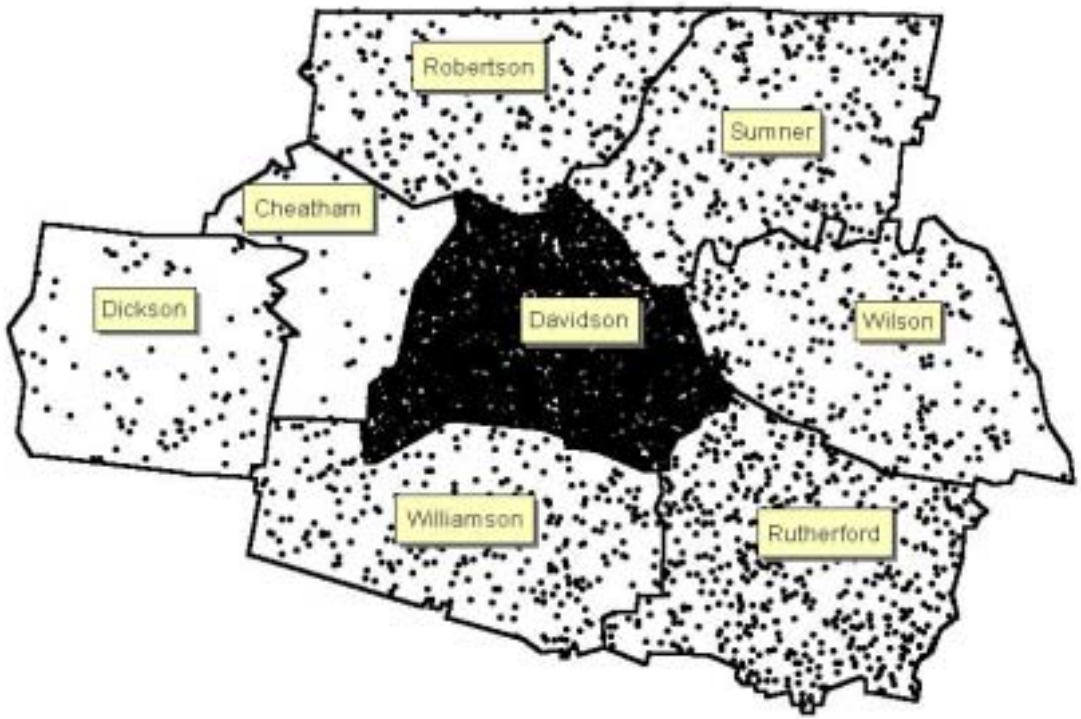


July 2004 – Black Enterprise Magazine names Nashville, Tennessee #4 among the "Best Cities for African Americans. The socioeconomic, demographic, and geographic analysis for the story was conducted by David A. Padgett.

Question: Is Nashville really a great place for African Americans to live, given the potential impacts of urban sprawl??? Can we use spatial tools to assess Blacks' quality of life in the city?


Nashville Metropolitan Statistical Area Counties - 2000
Robertson
Sumner
Cheatham
Wilson
Davidson
Dickson
Williamson
Rutherford

Distribution of African American Population
Nashville, Tennessee Metropolitan Statistical Area (2000)



Black Persons
· 1 Dot = 20

N
W E
S

30 0 30 60 Miles

Population Change in the Nashville, Tennessee MSA 1980-2000

County	1980 Total	1990 Total	2000 Total	Growth 1980-2000 (%)
Cheatham	21616	27140	35912	66.1
Davidson	477811	510784	569891	19.3
Dickson	30037	35061	43156	43.7
Robertson	37021	41494	54433	47.0
Rutherford	84058	118570	182023	116.5
Sumner	85790	103281	130449	52.1
Williamson	58108	81021	126638	117.9
Wilson	56064	67675	88809	58.4
MSA	850505	985026	1231311	44.8

Black Population Change Nashville MSA Counties 1980-2000

County	1980	1990	2000	Growth 1980-2000 (%)
Cheatham	595	570	532	-10.6
Davidson	106,369	119,412	147,696	38.9
Dickson	1,672	1,704	1,978	18.3
Robertson	4,960	4,526	4,691	-5.4
Rutherford	8,593	10,579	17,312	101.5
Sumner	5,084	5,381	7,540	48.3
Williamson	5,202	5,445	6,564	26.2
Wilson	4,873	4,685	5,563	14.2
MSA	137348	152302	191876	39.7

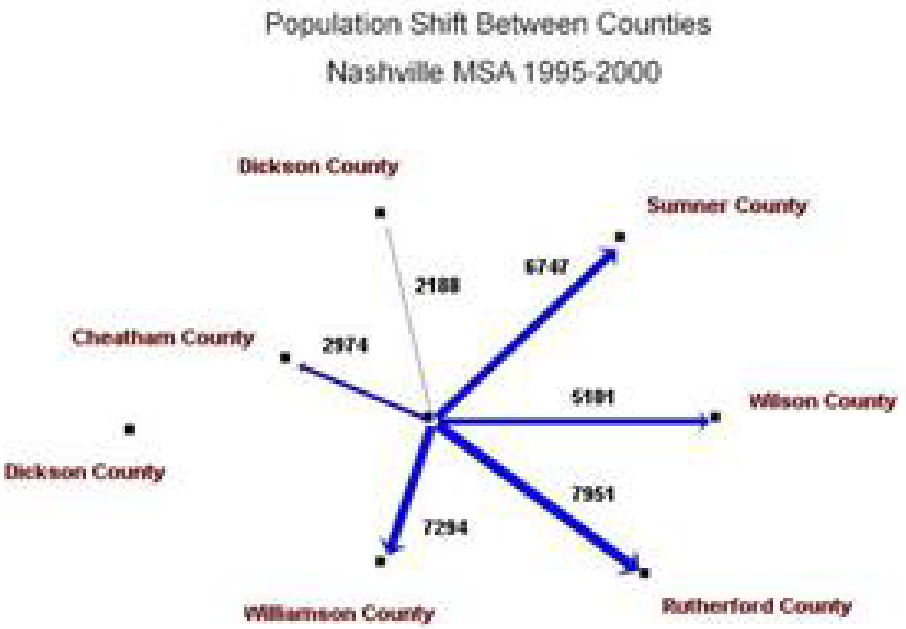
Percent Black Population in Nashville MSA Counties 1980-2000

County	1980	1990	2000
Cheatham	2.8	2.1	1.5
Davidson	22.3	23.4	25.9
Dickson	5.6	4.9	4.6
Robertson	13.4	10.9	8.6
Rutherford	10.2	8.9	9.5
Sumner	5.9	5.2	5.8
Williamson	9.0	6.7	5.2
Wilson	8.7	6.9	6.3
MSA	16.1	15.5	15.6

FlowMapper Input

From/To	Cheatham	Davidson	Dickson	Robertson	Rutherford	Sumner
Cheatham		1623	658	727	219	254
Davidson	4597		1387	3942	13163	10168
Dickson	214	824		43	202	116
Robertson	184	1754	20		375	1727
Rutherford	259	5212	172	160		362
Sumner	188	3694	81	1680	1327	
Williamson	333	5038	250	91	1496	212
Wilson	146	3748	31	143	1373	810

Modified Output From FlowMapper



Out-Migration from Nashville/Davidson County, Tennessee to Other MSA Counties 1995-2000

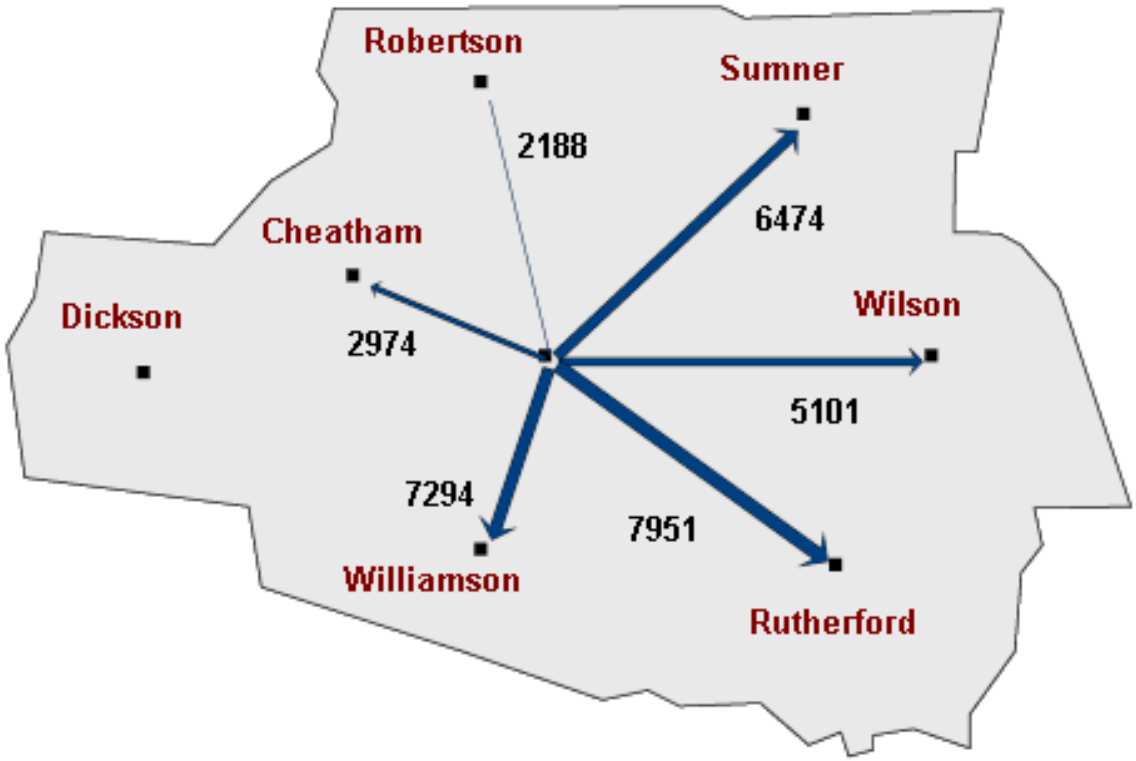


Image created using FlowMapper. Data were obtained from the U.S. Census at http://www.census.gov/population/www/cen2000/ctytoctyflow.html

Expected Results of Incorporation of Demonstration Modules with GIS and other Spatial Analysis Tools in

Urban Geography (GEOG 4850) Course

- Students will gain increased understanding of spatial and cartography principles.
- Students will be able to obtain data pertaining to an urban problem and then analyze the issues from a spatial perspective.
- The course will attract students from across the social sciences disciplines.
- Students will apply spatial analysis tools to support the efforts of local non-profit organizations, public schools, and government agencies.
- Students will produce term papers which will demonstrate their ability to think critically and spatially about issues inherent to urban environments.

SPACE

Spatial Perspectives on Analysis for Curriculum Enhancement

Summer Workshops 2005

- **Introducing GIS for Undergraduate Social Science Courses**
  1-6 August 2005, San Francisco, California

- **GIS and Spatial Modeling for the Undergraduate Social Science Curriculum**
  10-15 July 2005, Columbus, Ohio

- **Spatial Analysis for the Undergraduate Social Science Curriculum 18-23 July 2005, Santa Barbara, California**

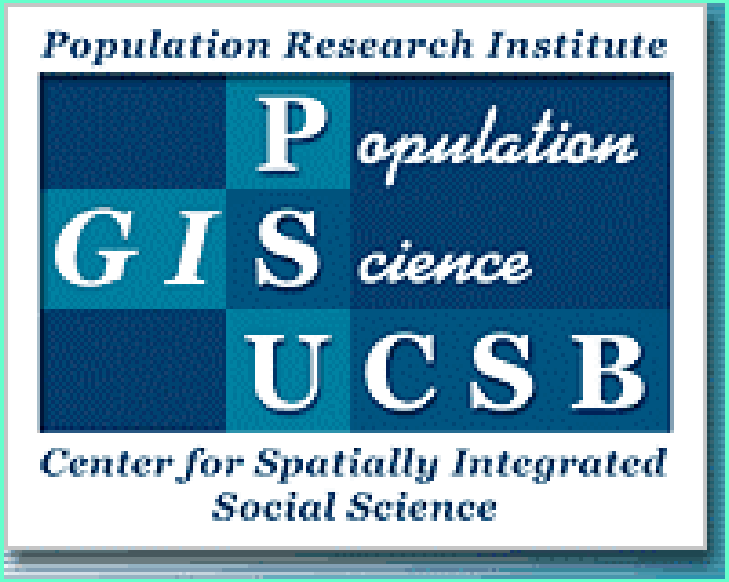
GIS and Population Science – Workshops 2005

- **State College, Pennsylvania: The Population Research Institute**
  The Pennsylvania State University, May 29-June 11, 2005

- **Santa Barbara, California: The Center for Spatially Integrated Social Science**
  University of California, Santa Barbara, June 19-July 2, 2005

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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