USING GEOSPATIAL REASONING IN INSTITUTIONAL RESEARCH: ST. PETERSBURG COLLEGE GEO-DEMOGRAPHIC ANALYSIS

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL
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To my parents

ACKNOWLEDGMENTS

To acknowledge those that have influenced my development of learning, I would first like to thank my parents for always being supportive, caring and there to keep me on the right track. I would also like to thank my colleagues and classmates who I continue to learn from. Lastly I thank Dr. Grant Thrall for guiding me through the master's program and allowing me to explore the field of spatial science as well as opening the door for me to pursue a doctoral degree in higher education administration.

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Geographic analysis has been adopted by businesses, especially the retail sector, since the early 1990s. Higher education can receive the same benefits as have businesses by adopting business geography analysis and technology. The commonality between business geography and institutional research for higher education is that both have trade areas, both provide services to clients (students), and clients can be geographically identified by their addresses as well as their psychographic profile. Among the valuable information that institutions of higher education can create using business geography are psychographic profiles of the student body, commuting patterns, and potential enrollment based upon the underlying demographics of the institution's trade area. A benefit of this analysis is the ability to anticipate the needs of the market. Understanding these geographic characteristics can assist in evaluating institutional objectives, and identify constraints on implementing these objectives.

My research is intended to provide a general guideline to geospatial reasoning in institutional research, assessment, and evaluation. Through literary examination as well as through the use actual data from a community college, the benefits of geospatial reasoning in institutional research will be identified. Within this report the student population of St.

Petersburg College is specifically addressed and analyzed for spatial patterns based on various characteristics.

CHAPTER 1
GEOGRAPHY AND HIGHER EDUCATION: AN INTRODUCTION INTO GEOSPATIAL PRACTICE AND INSTITUTIONAL RESEARCH

Foundations of Geospatial Reasoning

Geography has assisted in decision making throughout development of modern societies. Early explorers relied on their knowledge of geography and landscape to survive and succeed in global endeavors. Visual representations of the earth at various scales have been integral in planning and problem solving throughout history. The understanding of the geography of the earth has developed into many sub-disciplines of geography and other scientific disciplines, some of which can be universal tools for decision making. Cartography, planning, remote sensing, geographic information science, and even epidemiology use maps and spatial information to solve problems and make advancements within society.

In 1854 Dr. John Snow, sometimes referred to as the father epidemiology, used geospatial reasoning to discover the source of a cholera epidemic in a neighborhood of the Westminster area of London, England (Kovalerchuk 2005). By mapping the infected individuals (Figure 1-1) Dr. Snow was able to discover a direct correlation between the infection and the use of a single water pump proximate to the clustering of the infections.

This type of spatial reasoning has led to development of Geographic Information Systems (GIS). GIS can be defined as "a powerful set of tools for storing and retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes." (Burrough 1998). GIS is commonly described as having 5 main components; data, hardware, software, procedures/goals/plan, people, and a network. These components help describe the what and where of particular features on the earth's surface. GIS specializes in storing, analyzing, compartmentalizing, and describing the properties and attributes of a particular landmark or geographic occurrence (Bolstad 2002)

Over the last half century improvements in technology have allowed for tremendous development of GIS using complex computer systems. Along with the development of GIS was the development of the idea that geography could become explanatory in nature as well as descriptive (Harvey 1969). On the rise of GIS Martin (2005, p. 491) writes:

> the surge of this activity has been notable in geography, but it has been adopted substantially and simultaneously in the adjacent social and environmental sciences, in which speed and accuracy of data arrangement and delivery are of significance, spatial relationships increase the complexity of statistical analysis, and heterogeneous behavior makes computer based modeling essential. (Martin 2005)

Many other fields can benefit from geo-spatial analysis as well as sub-disciplines within geography. Education as a social science can benefit from the use of GIS methodology.

Business Geography: With the understanding that geography can go beyond the initial descriptive phase of reasoning, the use of geospatial technology began to present itself in business and industry and the sub discipline of geography, business geography, developed. Geographic analysis has been used by businesses, especially the retail sector, since the early 1990s. A pioneer member of the discipline, Dr. Grant Thrall, offers a comprehensive definition:

> Business Geography integrates geographic analysis, reasoning, and technology for the improvement of the business judgmental decision…This differentiates business geography from the traditional descriptive or explanatory objective of economic and urban geography. (Thrall 2002)

Dr. Thrall, professor of geography and expert in the field of applied and business geography, describes geospatial reasoning as a hierarchy of steps that allow for improved decision making. The five steps include: Description, Explanation, Prediction, Judgment, Management and Implementation (Thrall 1995). These steps can be applied to decision making in a variety of fields in the private and public sector.

Effective use of the five steps of geo-spatial reasoning require the application of “best practice’ methods. The first is assessment of the trade area of the business. The trade area can

be determined by evaluating the location of existing customers. Applications of GIS provide visual evidence of the trade area and allow the user to conduct experiments and draw relationships from information about the customer base and other geographic characteristics. An illustration of questions geospatial reasoning and technology can address when applied in the business sector include:

- What are the average drive times for customers from their home to the location of service?
- Are service providers drawing from each others' market area? (termed cannibalization in business geography)
- Do certain market areas need greater focus on recruiting and/or advertising?
- Are services provided based on geographic demand and are services offered in the correct locations?
- Are customers clustered by neighborhood, or uniformly dispersed around the trade area?
- Where are recommended sites for future expansion or service area reduction?
- Do customers seek out services from the nearest service provider or do they skip one outlet for another? If so, why is one location preferred to another? (Thrall 2002)

The above questions are general and could be asked by various types of service providers. This thesis will ask these questions with reference to trade area analysis for higher education institutions. Through the use of GIS and methods proven to be successful in business geography, higher education will be shown to more effectively serve all segments of the population.

Market penetration calculates how and where services of a particular business or service provider are reaching prospective consumers. Evaluation of the underlying demographics of potential customers of the service provider can assist in revealing relationships and characteristics of the market that can increase the level of market penetration. Psychographic profiles are also used in business geography to examine customers and the population of the trade area.

Psychographic profiles are a compilation of an individual's attributes relating to personality, values, attitudes, interests, and lifestyles. In business geography these are used to explain market forces and predict and judge current and future business or real estate undertakings (Thrall 2002). Neighborhoods and individual households can be organized into psychographic profiles and lifestyle groups. This type of analysis has proven to be effective in predicting and understanding consumer behavior as well as guiding decision making for retail and other business operations. ESRI's Business Analyst and MapInfo's TargetPro are leading GIS software programs that use psychographic analysis for business applications.

Another focus of business geography is analysis of site location. Thompson Associates, partners with the successful geospatial analysis software company MapInfo, have delineated ten crucial steps for site selection (Table 1-1). Another effective method for site selection is the use recorded data surrounding successful service locations in order to draw analogies for possible future locations. This method is known as the analog method within business geography (Applebaum 1966). The use of these site selection methods help regulate resource allocation, provide intuitive learning site location strategy, and assist in providing appropriate services in relevant locations.

Businesses have greatly benefited by having adopted geospatial technology and reasoning. However, other institutions of our society have lagged behind adopting business geography practices. Higher education institutes can benefit from the methods mentioned above.

Institutional Research

In any organization communication, research, and accountability are important for effective leadership and efficient operation. Higher Education is no exception. Higher education offices of institutional research provide these important functions within universities and colleges. A simple and effective definition of institutional research is "research conducted

within an institution of higher education in order to provide information which supports planning, policy formation, and decision making"(Saupe 1981). The office of institutional research provides important information for academic administrators, accrediting agencies and governmental officials. This information allows individuals within these organizations to make informed decisions.

Linking Geography to Higher Education. Higher education can receive the same benefits as have businesses by adopting business geography analysis and technology. The commonality is that both have trade areas, both provides services to clients (students), and clients can be geographically identified by their addresses. Among the valuable information that institutions of higher education can create using business geography are psychographic profiles of the student body, commuting patterns, and potential enrollment based upon the underlying demographics of the institution's trade area. A benefit of this analysis is the ability to anticipate the needs of the market. Understanding these geographic characteristics can assist in evaluating institutional objectives, and identify constraints on implementing these objectives.

My research is intended to provide a general guideline to geospatial institutional research, assessment and evaluation. Through relevant literary examination as well as through the use of data from a community college the benefits of geospatial reasoning in institutional research can be identified.

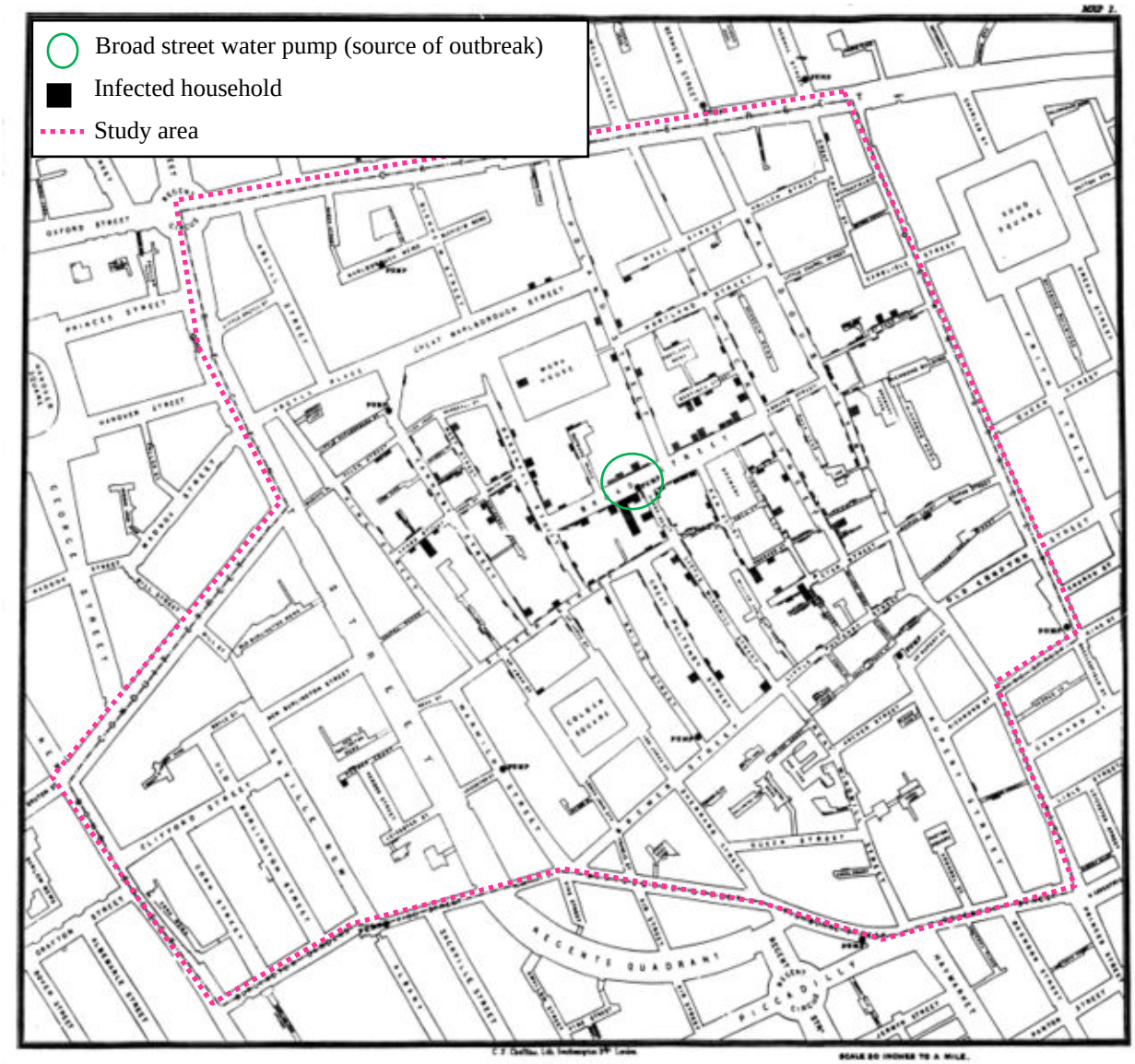


Figure 1-1. Map of the cholera infected area in Westminster region of London, England in 1854. (Retrieved on March 5th from http://en.wikipedia.org/wiki/Image:Snow-cholera-map-1.jpg. This image is in the public domain because its copyright has expired in the United States and those countries with a copyright term of life of the author plus 100 years or less)

Table 1-1. Winning the site selection race

The following 10 items represent a proven framework for assessing site selection opportunities:
1. Collect demographic data
2. Build an inventory of competition
3. Generate market characteristics
4. Quantify market demand for financial products and services
5. Understand customer account information
6. Recognize customer behavior patterns
7. Identify potential site location opportunities
8. Conduct fieldwork
9. Identify site characteristics
10.Develop final recommendations for senior management

(Thompson 2005)

CHAPTER 2
LINKING GEO-SPATIAL REASONING TO HIGHER EDUCATION: LITERATURE REVIEW

This chapter is a literature survey of geospatial reasoning and technology applied to decision making in higher education. Trends and themes used in business geography that can be applied in institutional research will be discussed along with other applied geographic techniques.

Also included in this chapter are significant functional foundations of institutional research. To give relevance and understanding to this investigation an identification of methods traditionally used for decision making, marketing students and managing enrollment will be included.

Advantages of GIS in Marketing

GIS Techniques: The use of geography to assist in market analysis can be traced back to the early to mid 20th century. Evolution within the field has occurred with the introduction of new technologies, particularly the automobile, which significantly modified the development of cities. This evolution of city development has expanded the discipline to studies on traffic flow as well as social and behavioral characteristics. Within business and industry these studies were supplemented with people's lifestyle preferences. The growth in capabilities of the modern computers and the introduction of GIS (Geographic Information Systems) enabled many disciplines to significantly enhance data analysis, storage, and display with the added spatial component that is lacking from all other data analysis technologies. In the business sector the use of geospatial technologies along with lifestyle segmentation profiles has greatly increased our understanding of trade areas and the demographic composition of those trade areas (Thrall 2002). Table 2-1shows the benefits of using GIS for marketing (Piccillo 1999). Prior to the

ubiquitous use of GIS in marketing and business some groundwork was established by highly influential theorists such as William Applebaum.

William Applebaum, a geographer who was able to apply the techniques of geography to business and marketing, is regarded as a founding father of business geography. Numerous publications in academic journals as well as business and marketing volumes document his success at merging the discipline of geography to business practices (Ghosh 1987). Applebaum's contributions to business geography include the customer spotting method, the analog method, market penetration methods, and methods for determining store location (Thrall 2002). The methods developed by Applebaum that most impact this study are the customer spotting and market penetration techniques.

The customer spotting technique involved surveying of the customers or recording information from license plates or cars in the parking lot in order to obtain customer addresses. This technique allowed Applebaum to determine the trade area for a particular establishment. A trade area is the geographic region for which a business draws most of its customers (Ghosh 1987). In discussions about customer spotting Applebaum delineates trade areas into three distinct zones:

1. Primary Trade Area: This area is comprised of 60-70% of the customer base (analysts now most frequently consider 80% capture of the customers as the primary trade area).
2. Secondary Trade Area: This area is comprised of 15-25% of the customer base.
3. Tertiary Trade Area: This accounts for the residual customers. This consists of sporadic customers or out of town customers (Thrall 2002).

The method used by Applebaum for customer spotting has given way to the much more efficient practices of collecting bank data, credit card data, and point of sale data such as ZIP codes (Thrall 2002). Once this descriptive customer data has been collected, locations (whether

it is address, ZIP code, or ZIP +4) can be programmed into a digital map using geospatial technology, including software and specialized databases. This process, called geo-coding, allows for the demarcation of trade areas as well as a variety of other spatial analysis. Knowing the location of the customer base gives the service provider the ability to describe the relationship between store and customer with other descriptive variables. David Loudon (Loudon 1979) describes the collection of cognitive information by consumer researchers below.

> Consumer researchers who desire to know about their market more than just demographic characteristics may attempt to collect cognitive information; that is, information about consumers' knowledge, attitudes, motivations, and perceptions. Merely observing consumers cannot fully explain why they behave as they do, and questioning often does not provide reliable answers because of consumers' inability or reluctance to reveal true feelings to an interviewer. Thus, researchers attempt to explore intervening variables potentially useful in explaining consumer behavior by utilizing other techniques (Loudon 1979).

Knowing the locations of the customers is a beginning step for market researchers. The intervening variables mentioned above can be summarized through the use of lifestyle segmentation profiles. Lifestyle segmentation profiles (LSPs) are classifications of a neighborhood that incorporates many different variables such as family status, income, consumer spending behaviors, media and advertising influences, and even leisure and recreational activities. These variables collectively represent the households in a particular neighborhood. The first step in creating LSPs is defining the scale at which the profiles will be used. The scale can range from a Census block group to ZIP+4 designations. The smaller the geographic area the more accurate the assigned LSP is likely to be. Census blocks are the smallest geographic area for which the Census reports data. The shapes of census blocks follow the geographic pattern of the streets, and are generally in between intersections. Residences included are usually back to back rather than on opposing sides of the streets (for further explanation on U.S. Census Bureau reporting units see (Thrall 2002) or (Hamilton and Thrall, 2004)).

Once the geographic level has been established the variables are clustered together based on similarities and a set number of clusters, or lifestyle segments are produced and one LSP is assigned to each geographic area. Once customer addresses are geocoded they can be appended to an LSP. These techniques will be illustrated and expanded upon in chapter four.

Spatial Information in Education

Support for GIS in Higher Education: Presently, there is a limited supply of resources that document research using GIS in institutional research. However, those that contribute significantly to the field of IR will be discussed in this segment of the paper. Topics that relate to the use of GIS in education will also be discussed. One such topic is equity in the administration of financial aid.

A problematic issue for college administrators striving for financial aid equity is determination of student socioeconomic status (SES). SES is currently difficult to measure for college students (Bailey 2006). Unless a student files for financial aid administrators have found no easy way to determine his or her status, which determines if the student needs to be awarded a grant or other funding. However this problem can be addressed using GIS. Using the student's address and what can be determined from neighborhood analysis GIS researchers can determine a students' SES (Crosta 2006).

The Community College Research Center (CCRC), regarded as one of the leaders in research on community colleges, is based at Columbia University in New York. Recently a study was conducted by the CCRC that details the use of student addresses to determine socioeconomic status (Crosta 2006). The study was conducted using data from the Washington state Board of Community and Technical Colleges. The goal of the study was to provide the board with accurate information on student SES for the purpose of making informed policy decisions and improve service to residents of the state through the various community and

technical colleges. The CCRC used two methods to achieve this goal. The first process is determining SES from student addresses and census block groups, and the second process involves using cluster analysis to create segments of the population.

The first process, deriving SES by address location, is achieved through the use of GIS. The process, summarized in table 2-1, defines student SES by using household income, education, and occupation as indicators. This use of appending census data to individual addresses is important because it gives decision makers specific information about characteristics of residents living at these addresses and comparisons of tabulated data can identify patterns within a particular population. For this study the population is community college students of Washington State.

The second method used to better understand the relationship of the population to characteristics of students is called cluster analysis. Cluster analysis is the use of multiple algorithms to group objects with similar characteristics into categories. In this study cluster analysis was used for grouping census block groups that have similar traits into "community clusters". Cluster analysis is very useful at grouping large datasets, but the composition of the resulting groups depends on variables used and parameters designated. In the Washington study the variables used were demographic variables "relevant to community college educators" (Crosta 2006).

Using clusters, according to the authors, is more descriptive and effective in determining SES than using the three indicators (income, education, and occupation) mentioned in the section described earlier. In the CCRC study the Washington Census block groups were divided into 15 individual clusters with distinctive characteristics. Once the clusters are determined, students within the state can be assigned a cluster based on home address. These clusters can also be used

to determine the level of market penetration of particular demographics throughout the state and " in indentifying particular communities where students may face barriers to college access" (Crosta 2006). A summary of the steps involved in the cluster analysis is shown in Table 2-2. Further recommendations from this study will be discussed in the concluding chapter of this paper.

Further demonstration of the use of GIS in higher education can be seen by examination of the office of IR at the University of Memphis (U of M). Memphis has used GIS to map students and alumni since 2001. The webpage for the IR office has a collection of interactive maps (http://oirmaps.memphis.edu/maps/map_index.htm). This collection includes:

- U of M Undergraduate Retention and New Enrollment, Fall 2005 (U.S.)
- Current Off-campus Class Locations and Underrepresented Areas (Shelby County, TN)
- U of M Undergraduate Applicants / Acceptees / New Enrollees, Fall 2005 (Tennessee)
- U of M Graduate Applicants / Acceptees / New Enrollees, Fall 2005 (Tennessee)
- U of M Students by Home Zip Code Area, Spring 2006 (Shelby County and nearby counties - TN, AR, MS)
- Undergraduate Students by High School Attended, Spring 2006 (Shelby County, TN)
- Foreign Graduate Students Attending U of M, Spring 2006 (World)
- Foreign Undergraduate Students Attending U of M, Spring 2006 (World)
- U of M Active Alumni (by zip code area), May 2004 (continental U.S.)

The maps displayed on the University of Memphis website demonstrate the capability of GIS to track and manage students and alumni. This gives university administrators the ability to easily see where students are coming from and as well as areas to target for alumni donations or areas with underrepresented segments of the population (Donhardt 2001).

Maybe the most significant source of literature discussing the use of GIS in higher education is the Winter 2003 edition of the quarterly sourcebook sponsored by the Association of Institutional Research, *New Directions in Institutional Research*. The individual chapters each detail a different utility of using GIS in institutional research (IR) and the benefits associated. Typical applications offered by the book include:

- Using Census data and existing knowledge of student demographics to inform decisions with consideration of planning and implementation of recruitment strategies and tactics.
- Building student databases and displaying enrollment trends with maps for visualization and analysis.
- Use of GIS in survey research for design, analysis, and reporting of survey data.
- Campus planning and facilities management; GIS in a traditional planning capacity.
- Mapping and analyzing alumni donation patterns. Through the uses of address data and demographic data alumni associations can better understand where to focus future campaign activity (Teodorescu 2003).

Resource allocation in higher education is directly linked to state legislative bodies. Geographic techniques can be used by institutions to inform state legislators of the influence of their university on the legislative districts throughout the state (Thrall and Mecoli 2003). The University of Florida's student address database was recently used for this purpose. By spatially joining the addresses of the students to the state legislative districts, the University of Florida was able to show the impact of the school per district, and therefore the value of the university throughout the state (Thrall and Mecoli 2003).

Institutional Research and Decision Making

The examples described in this chapter exemplify significant justification for incorporation of geospatial methods in college and university planning and decision making. The following section of this chapter focuses on key functions of institutional research and existing decision

making methods. Administrative functions in enrollment management, assessment, marketing, and institutional objectives will be examined along with traditional methods of decision making for these functions will be discussed.

Enrollment Management

The Association of Institutional Research (AIR) is an excellent source for information and literature describing IR. A recent publication from the AIR, *The Primer for Institutional Research* (Floyd 2005), aptly and comprehensively describes the key functions and duties related to IR.

The Primer for Institutional Research analyses and reports on the current issues surrounding institutional research in higher education (Knight 2003). The book is a compilation of nine chapters written by practitioners within the field of institutional research. Each of the chapters addresses a separate issue. According to the editor this book is "designed to provide an introduction to some of the more common institutional research issues, methods, and resources for newcomers and to provide means for veterans to update their capabilities." This volume is in essence an update to previous publications of the same variety from the Association of Institutional Research in Tallahassee, FL. One of the chapters of the *The Primer for Institutional Research* is titled Enrollment Management.

Enrollment management is defined in *The Primer for Institutional Research* as "an institutional research function that examines, and seeks to manage, the flow of students to, through, and from the college." The educational pipeline is a term used to describe student recruitment processes. The questions "Who does the institution want to educate?" and "Who is available?" determine the educational pipeline. Once these questions are addressed "the next step is to identify data sources that summarize how many pre-college students with these characteristics exist in the pipeline" (Knight 2003). The use of geospatial techniques can greatly

assist in this process by tailoring institutional programs to the currently and future enrolled students.

There are certain measures that are effective in predicting student success in the collegiate setting (Knight 2003). High school GPA in combination with standardized test scores is typically best at predicting college GPA and retention in the first year of college. However, the authors of the chapter on enrollment management show that this combination does not do a particularly good job predicting success and retention after the first year and does a relatively poor job of predicting which students will graduate after four to six years. This is evidence for putting less emphasis on merit based financial aid. If merit is not a good predictor of who will succeed and graduate, then more emphasis should be put into need based aid.

Decision Making

Traditionally the Institutional Research office has relatively few direct responsibilities, but this is changing. Some institutions combine IR with planning (Walleri 2003). Two planning considerations from the IR office that can be assisted with GIS are demographic and population projections as well as enrollment analysis and forecasting. Most IR offices do not incorporate a spatial component in the planning process, so to better understand the benefit of using a GIS in planning an examination of current considerations for decision making in post-secondary education is presented below.

Decision support may take many forms and various levels of analytic complexity (Howard 2001). According to Terenzini (Terenzini 1993) there are 3 levels of intelligence in administration in higher education. The first tier, technical intelligence would include abilities in conducting surveys, cost benefit analysis, and data collection, manipulation, and analysis. This typifies the primary day to day operations of an IR office and consists of numeric tabulated data. The second tier, issues intelligence, includes a understanding of institutional decision making.

This level of intelligence requires good communication and organizational skills along with the ability to *integrate methodologies and knowledge from multiple disciplines* to design a study and interpret results. The highest tier, the contextual intelligence, encompasses the ability to effect change through the use of both quantitative and qualitative information (Terenzini 1993). Understanding these three levels of intelligence can help understand the implicated role for the use of GIS in IR. The use of GIS, a methodology from an external discipline, can assist in both the technical and issues levels of intelligence through capabilities of data storage and analysis as well as the ability to design a study and interpret results (Howard 2001).

The use of GIS in education planning is can assist the persons responsible for the summarized process that leads to decision making presented below(Howard 2001).

1 The initial collection and storage of data.

2 The use of the resulting information to make decisions.

3 Effective communication of useful information for decision making.

Depending on the nature of the decision, all three steps could benefit from the visual and analytical potential of geospatial analysis. Though not frequently used for most decision making models in the higher education system in the US, GIS is a data system accompanied by spatially explicit methodologies that would be useful for the implementation of key components of decision making.

MEDIA BUYS:
Once the precise location of your customer base is known, you can make cost effective media buys that get the right message to the right target. For example, by using the knowledge gained from mapping their customer base, a marketer who wants to place inserts in a local newspaper can target the neighborhoods with the highest level of customers.
Competitive analysis:
Plotting the location of the competition (direct and indirect) on a map is much easier to understand than a list of locations on a report. You can adjust your marketing strategy to fit the number of competitors in the immediate geographic area.
Drive-time analysis:
Mapping your customer drive times is useful for analyzing cannibalization issues, new store placement and competition. By plotting the drive-time area on a map, you clearly see any overlap among various business locations and competitive sites. Barriers such as military bases, airports, parks or college campuses all influence your customer's drive time, but those barriers are not apparent on reports.
Market-entry planning:
Using demographic mapping for market-entry planning clearly identifies sales potential in a region. For market entry, be sure to look at retail sales potential, lifestyle segments, propensity to use or purchase products and services, population, income, age, number of businesses and competition. Using a thematic map, your marketing strategy can be tailored to fit the new market's unique characteristics.
Budgeting:
For comparisons, demographic mapping is invaluable. Analyzing maps for each geographic area enables marketers to determine where to allocate their budgets. Areas with high growth potential or high sales potential are quickly spotted and marketing strategies can be adjusted accordingly.
Lifestyle segmentation:
Used in conjunction with demographic mapping, segmentation is a great tool for identifying quality prospects. Lifestyle segmentation systems use demographic and aggregated consumer demand data to classify every household in the United States into a unique market segment. Each segment consists of households that share similar interests, purchasing patterns, financial behavior and demand for specific products and services.

Figure 2-1. Advantages of demographics mapping and possible further analysis (Picillo 1999).

Table 2-1. Summary of steps to find socioeconomic status from block groups

Summary of Steps to Find Socioeconomic Status from Block Groups
1. Acquire student addresses.
2. "Geocode" student addresses by converting them into latitude and longitude points.
3. Create GIS data containing student latitude and longitude points.
4. Acquire Census geodata at block group level.
5. Match, or geographically intersect, student data points to block groups.
6. Assign SES variables from Census data at the block group level to each student.

Table 2-2. Summary of steps to involved in cluster analysis

Summary of Steps to Involved in Cluster Analysis
1. Decide geographic level.
2. Select variables.
3. Standardize variables.
4. Choose cluster methodology, and if necessary, distance metric and linkage method.
5. Run cluster algorithm.
6. Indentify the number of clusters to be defined.

Table 2-1, Table 2-2. Crosta, P., Leinbach, Timothy, and Jenkins, David (2006). "Using Census Data to Classify Community College Students by Socioeconomic Status and Community Characteristics." Community College Research Center: Research Tools No. 1: 12.

CHAPTER 3
CURRENT ISSUES IN HIGHER EDUCATION

This chapter will bring current and common problems that exist in higher education into context with the notion that geographic techniques can benefit institutional research. By examining relevant reports and published literature, issues will be identified that can be addressed or improved upon through the use of geo-demographic analysis and geo-spatial reasoning. This survey of literature will establish grounds for the use of geography in analytical reasoning in higher education and examine existing studies and literature that address the use of geographic information systems in education.

United States Higher Education

Education is considered the hard core of human capital theory (Sahota 1978). With global specialization human capital has become one of the most important factors of production from the local to global scale. With the focus on specialization of production and particularly on the technology industry, education and the development of specialized skills across the entire population is of increasing importance. Of particular interest for this study is the distribution of access to higher education opportunities. This distribution has far reaching effects. Unequal distribution can lead to an insufficiently educated population and thus affect the economic and social structure of society.

Relative to most countries the United States has one of the most unique and successful higher education systems in the world (Clark 1990). The success of the higher education system in the US is partially dependent on the structure of the system. The de-fragmented organizational structure, along with many other factors, has allowed U.S. tertiary education systems to adapt and grow to the point where they are now some of the best in the world (Lucas 1994). The success of higher education in the U.S. is far from flawless. Current flaws that have

been identified recently through research will be discussed here. This section of the study will include issues that can affect institutions throughout the country, but because of the geographic location of the study that will be examined in the next chapter, issues specific to the state of Florida will also be addressed.

Inequality

Inequality in higher education has always been an issue. Following World War II the Montgomery GI Bill challenged this issue and resulted in the many minorities having the opportunity to go to college. Although the GI Bill allowed minorities the opportunity to attend college it did not have the effect of creating equality in tertiary education (Greenberg 1997). Since the GI Bill took affect state and federal governments have instituted policies and procedures such as the FAFSA (Free Application for Federal Student Aid), Pell Grant, race based admissions, affirmative action in faculty hiring, and other means designed to assist the financially unprepared and racially underrepresented (Lucas 1994). Equal opportunity to attend college is still an issue of importance to the U.S. Department of Education and is addressed in a recent report published by this department.

In September 2006 a commission formed by the Secretary of Education, Margret Spellings, released a report discussing the current state of higher education (Spellings 2006). The report describes the need for a "new landscape [that] demands innovation and flexibility from the institutions that serve the nation's learners", thus implying that the current system is not adequately meeting the needs of students. Currently students are getting their education from a variety of sources, all of which should offer services that accommodate needs for students from all backgrounds and categories. The report mentions the "consumer driven environment" and describes students as results driven. Students are receiving education from multiple avenues and institutions and forty percent of the 14 million undergraduates in the U.S. are attending two year

community colleges (Spellings 2006). This emphasizes the need for a focus on the services provided by two year institutions.

One section of the Spellings report discusses access as a concern. On access for minorities the commission writes, "we are especially troubled by gaps in college access for low-income Americans and ethnic and racial minorities." The population in the U.S. is growing the fastest in the groups of people that fall into the category of non-traditional and underserved students. This shift in demographics will constitute an ever increasing proportion of the workforce, a workforce that needs proper education and training. The community college can play a great role in training and educating these groups of people, and according to the report "provide a place to begin for many of these students" (Spellings 2006).

Evidence from the Spellings' commission report supports the fact that eligible young people from low income families are far less likely to attend college than young people with similar qualities from high income families. The percentage of whites that obtain a bachelors degree by the age of 29 is around 34%, compared to 17% of blacks and 11% of Latinos. The most alarming finding is that low income high school graduates that score in the top quartile on standardized tests attend college at the same rate as high-income high school graduates in the bottom quartile on the same tests. This statistic suggests that although low income graduates are capable of being successful in higher education, other factors (for the most part financial restraints) limit these students and they are not afforded the same opportunities as high income students to further their education.

This occurrence is further evidenced by a study published recently by an independent nonprofit organization called The Education Trust. The study discusses the nation's premier public institutions and shortcomings in regards with equal access. One section of the study

reports on funding and figures surrounding financial aid. Currently the average institutional grant aid for families earning over $100,000 annually is nearly $4,000, which is lower than the amount granted students from families earning $40,000 or less (Gerald 2006). Another finding from this study similar to reports by the Spellings' commission was that talented high income students were four times as likely to end up at a highly selective university than a low income students of equal talent (Gerald 2006). Similar findings in reports from differing organizations indicate that this trend is apparent regardless of source or data bias.

Another study conducted by the Educational Testing Service discusses three distinct concerns that will cause considerable changes in the future of higher education (Kirsch 2007). The three forces include divergent skill distributions, the changing economy, and demographic trends. An indicator that America's skills are greatly varied is embodied by surveys that show that the U.S. has a degree of inequality (a representation of the gap between the least and most capable) that is among the highest in OECD (Organization for Economic Cooperation and Development) countries (Kirsch 2007). Signs that the nation's economy is dramatically changing are also offered in the report America's Perfect Storm. Since 1950 the proportion of manufacturing jobs has dropped from 33.1% to 18.2% in 1989 and by 2003 down to 10.7%. Twenty of the thirty million jobs that have been created since 1984 jobs associated with college level education. Not only is the U.S. losing low skill manufacturing jobs, it is at the same time gaining a high proportion of jobs that require advanced education (Kirsch 2007), evidence of the increasing need for further the education level of the workforce. In 1979, the expected lifetime earnings of a male with a bachelor's degree was 51% higher than a male without a degree, and by 2004 this estimate stands at 96%. Without offering equal opportunity for further education the increasing gap in skills will only serve to promote economic disparities within the country and

hence result in other social issues related to educational inequality (as discussed further in (Chakravorty 2006)).

The demographic trends mentioned in the The Perfect Storm are also significant. By the year 2030 the Hispanic population will exceed 20 percent of the total population. The authors of this article cite The American Community Surveys as reporting that in 2004 approximately 57% of the 16-64 year old Hispanic population in the U.S. is foreign born and around half of these immigrants do not have a high school diploma.

The inability to close the existing skills gap and significantly enhance the literacy levels of all Americans will result in demographic changes that leave the population in 2030 with "tens of millions of adults unable to meet the requirements of a new economy" (Kirsch 2007). If these tens of millions of low income people are going to narrow the skills gap and improve their literacy levels enough to survive they will need the help of institutions such as the community college.

Through examination of recent studies on higher education and trends that affect higher education a pattern has been identified. An increase in the number of citizens in need of basic skills, along with a trend in higher education for academic elitism has created a gap between prepared and under-prepared, and this gap is yet widening. Efforts from the premier state universities to elevate standings at the expense of equality of access have created a trend that flows down the hierarchy of higher education. This drive for prestige has caused institutions to abandon traditional values and roles in the community for a better name amongst peer institutions. This effect, deemed mission creep, effects even community colleges and community colleges and workforce training institutions have the highest potential for decreasing the skills gap mentioned above (Campbell 2005).

Another study recently completed by the Western Interstate Commission for Higher Education (WICHE) discusses the financial aid and student success (Hauptman 2007). This report again points to access as a major issue for higher education. This report by WICHE makes some recommendations for improving access. One key recommendation related to this paper is the recommendation for improvement in "collection, analysis, and presentation of data on how well federal and state support of policies are targeted toward low income students"(Hauptman 2007). The report goes on to discuss how currently aid programs are not well targeted toward the poor. According to the commission, "this lack of targeting reinforces chronic inequalities at each stage of the educational pipeline" (Hauptman 2007). Addressing policy design and implementation, the author finds that availability of data, research, and insightful analysis is limited prior to legislative decision making and program implementation. GIS provides the tools that have insightfully informative analysis and presentation capabilities. State and Federal education agencies stand to improve decision making through the use of geospatial analysis.

Prior to descriptive analysis the commission identifies three objectives, which are listed below:

- Strengthen educational opportunities for students through expanded access to programs.
- Assist policy makers in dealing with higher education and human resource issues through research and analysis.
- Foster cooperative planning, especially that which targets the sharing of resources.

These three objectives are worth mention here because the topic of this paper, using geographic techniques to improve education decision making, is related. These objectives along with the commission's recommendations can be affected and improved upon through the use of GIS for targeting segments of the population that are underserved.

Higher Education in Florida

The study presented with this paper and discussed in the following chapter, deals with geo-demographic analysis conducted for St. Petersburg College in Pinellas County, Florida. Giving consideration to the study, it is pertinent to discuss issues in higher education that specifically affect the state of Florida. Current issues along with a discussion of the implication of the use of GIS will comprise this section of the paper.

The changing demographics and increasing population for the state of Florida is a concern for the Florida Board of Governors (FBOG) for the State University System. In the last decade the growth of population of 18 – 24 year olds has grown in Florida by 24.6% and will see an increase in 19.5% (roughly 10.5% more than national projections) from 2004 to 2014 (Pappas 2007). This spike in college age population requires additional needs for access to higher education. The Florida Board of Governors recognized this and hired the Pappas Consulting Group to assist in planning for the future needs of college students within the state. The consulting group concluded investigation and published a detailed report in January 2007.

Recommendations from the group included the use of the California model of the 3 tiered system with clear delineation between research one, state college, and community college systems. According to the consulting group the use of state resources for the additional openings of medical schools, the additional emphasis of state universities on research and the granting of baccalaureate degrees from community colleges constitutes “mission leap” (Pappas 2007). Designation of clear mission parameters will limit the unnecessary use of valuable and diminishing state funds.

Programs such as the Bright Futures Program (BFP) are also addressed by the consulting group. Bright Futures was established to “reward any Florida high school graduate who merits recognition of high academic achievement” (Florida Bright Futures Scholarship Program, 1997,

p.1). To initiate the program existing merit scholarships in the state were combined and funding was provided by the Florida Lottery system. A summary of the requirements for high school graduates is listed in Table 4-1. The Pappas group found that the program has spent 1.6 billion dollars since 1997, when the program was instituted, and most recipients were non-need based students. Opposition for the BFP can be readily found as some researchers protest the use of state funds for students that do not need assistance.

One study conducted by researchers at North Florida University provides evidence that indicate lottery-funded merit scholarships redistribute income from lower income, non-white, and less educated households to higher income, white, well-educated households (Borg 2004). Within the sample chosen by the research team the authors find that high socioeconomic (SES) households receive a net program benefit from Bright Futures while low SES households incur a net program loss. Numerous studies show that low-income households pay more in lottery taxes. The researchers from North Florida found that these low-income households are much less likely to receive a BF scholarship. They also found that of the low-income households that do qualify for BF, they are more likely to receive the FMS scholarship that only pays 75% than high-income households (Borg 2004). Programs such as the BF in Florida can and should be replaced by programs that place as much emphasis on need as is on merit. Identifying the segments of the market that are in need can be done through the use of GIS.

Planning can be greatly enhanced with the use of information systems such as GIS. Considering the demographic changes projected for Florida over the next 10 to 15 years planning in higher education is vital. The Atlas of the State University System of Florida (Thrall 2005) exemplifies the merits of the use of geographic technology for planning in higher education. In 2004 The Florida Board of Governors (FBOG) requested consulting service from Dr. Grant

Thrall for analysis of the geographic access to the state university system (SUS). Thrall's analysis provides immense planning potential for the SUS, and can be duplicated by other university systems elsewhere. Thrall's (2005) report uses a variety of methods for delineating trade areas for the universities in the SUS and addresses both the needs for key fields of education around the state and the supply of these degree programs and graduates with these degrees. Examples of the work provided to the FBOG (Florida Board of Governors) can be seen in Tables 3-1, -2, and -3. This analysis provides further evidence of the utility in the use of GIS in planning for higher education at the highest level.

Chapter Conclusion

The important role has been established for geospatial analysis at the university system level and at the community college level, therefore justification is given to the importance of effective resource allocation. Workforce development programs and other fundamentals characteristics of the community college are very important for advancement of society as a whole. This paper provides evidence for use of geo-spatial applications in improving the administration of these fundamental operations in the community college and other realms of higher education. By examining the current issues in higher education a gap has been identified that geo-spatial science and techniques can begin to fill.

Using data and collaboration with St. Petersburg College in St. Petersburg, FL, the following chapter will illustrate specific benefits of using geospatial reasoning for planning, implementation of institutional objectives, and enrollment management.

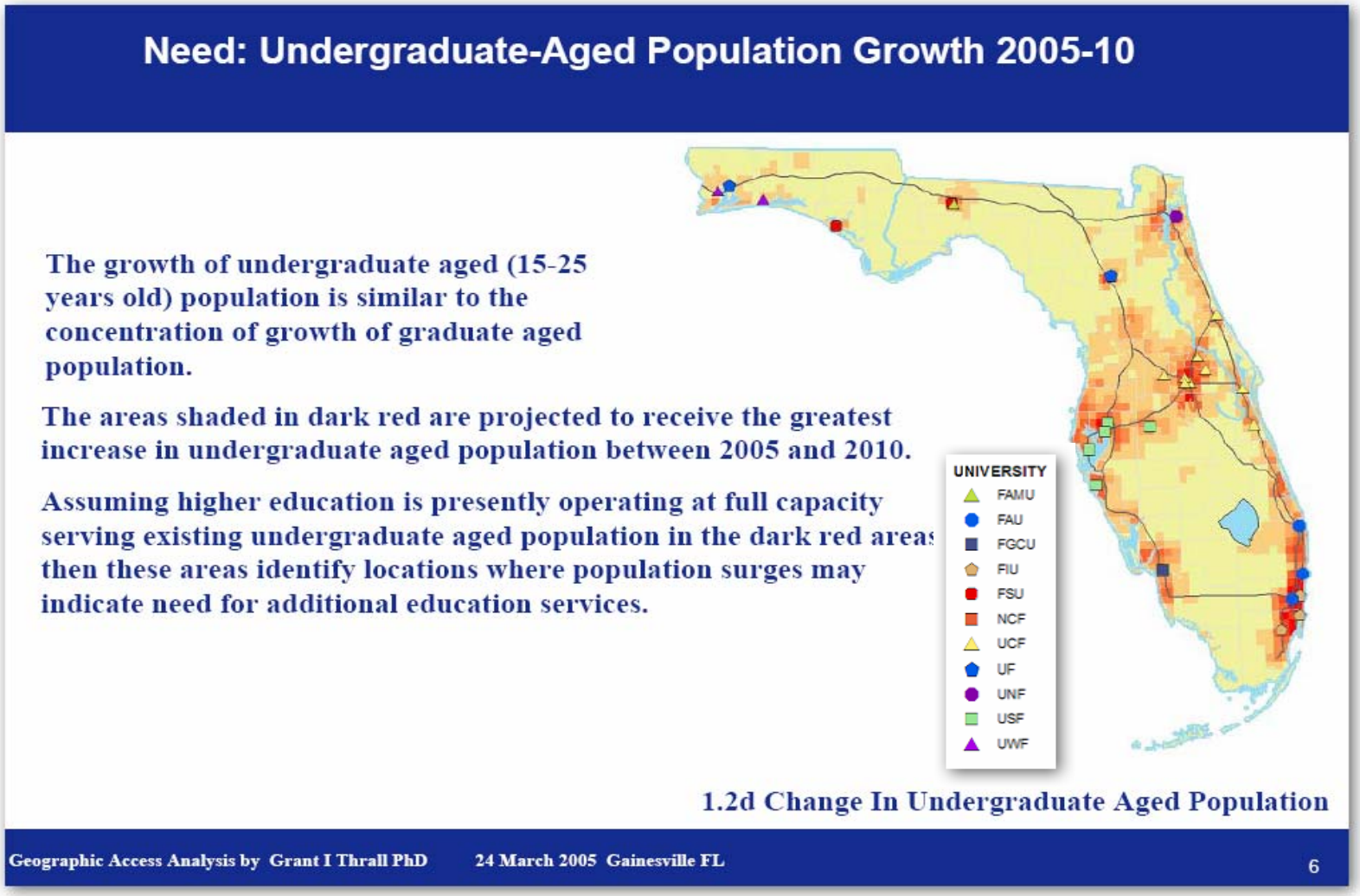


Figure 3-1. Summary Overview of The Atlas of the State University System of Florida. This map shows the projected increase in undergraduate aged population in Florida by the year 2010. (Thrall, G. 2005)

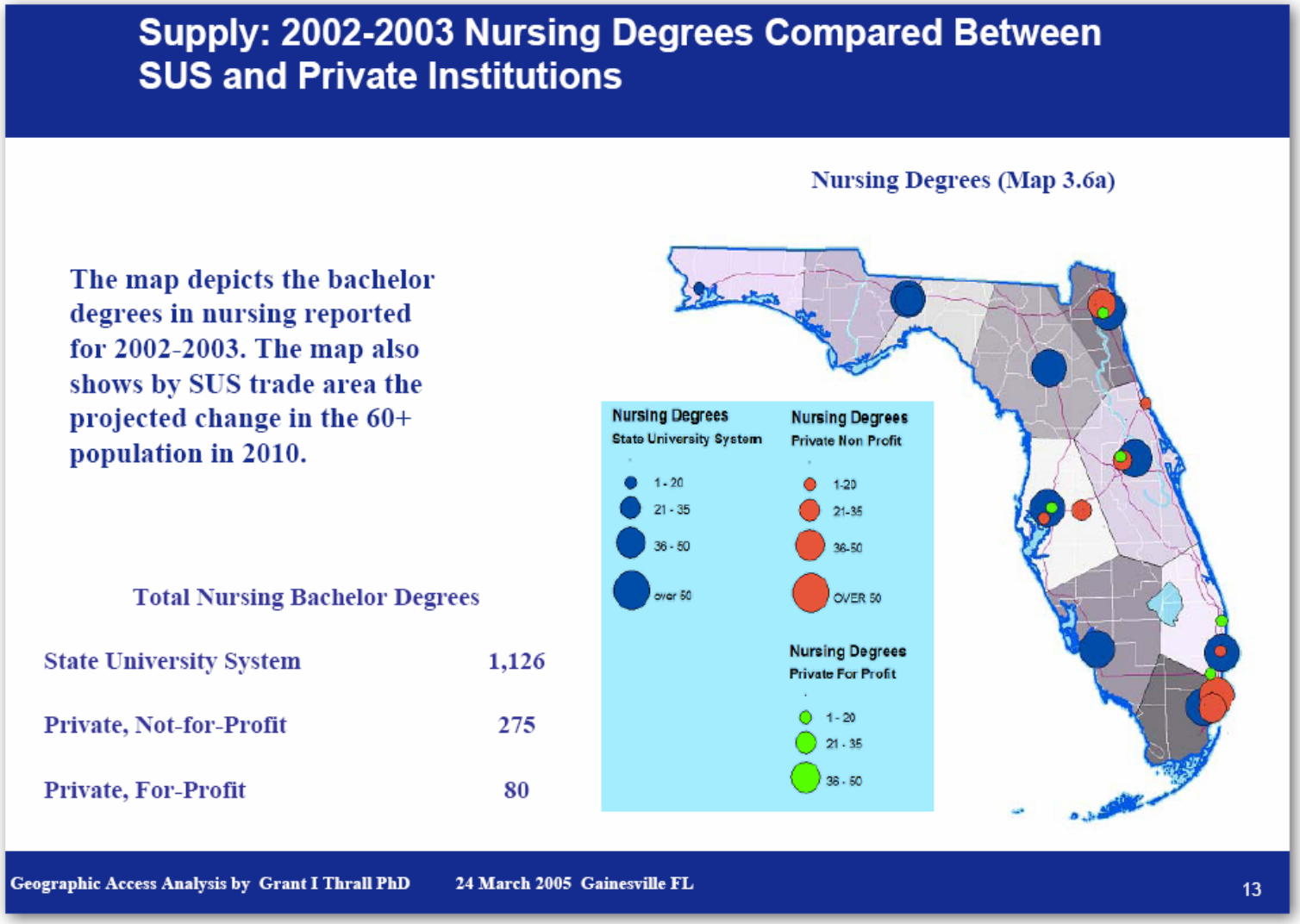


Figure 3-2. Summary Overview of The Atlas of the State University System of Florida. This map shows the supply of nursing degrees granted in Florida in 2002-2003 school year. The shaded areas are major SUS trade areas. The darker shaded regions represent a higher projected rate of change for the population age group 60 and over. (Thrall, G. 2005).

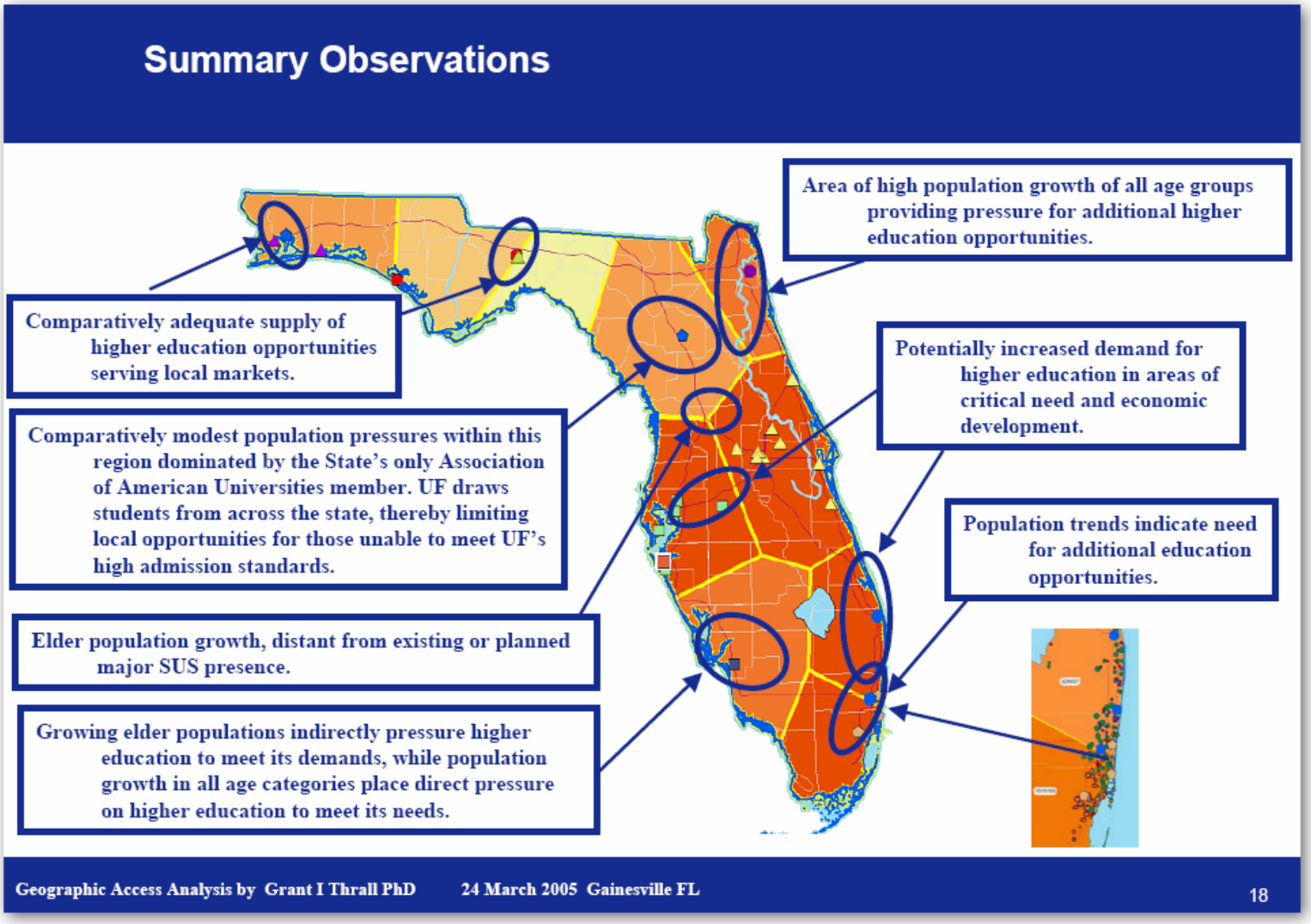


Figure 3-3. Summary Overview of The Atlas of the State University System of Florida. This map shows the summarized conclusions for the The Atlas of the State University System of Florida. Gainesville. This type of analysis can be done by institutional researchers within colleges and universities. (Thrall, G. 2005)

Table 3-1. Florida Bright Futures award requirements.

Award	Award Level	*GPA	Required Credits	Community Service	Test Scores
FAS	100% tuition and fees	3.5	15 various college prep courses	75 hours to be approved by the college	1270 SAT 28 ACT
FMS	75% tuition and fees	3.0	15 various college prep courses (same)	No requirement	970 SAT 20 ACT
GSV	75% tuition and fees	3.0	15 various college prep courses (same)	No requirement	840 SAT

(Florida Bright Futures Scholarship Program, 1997, p.1)

CHAPTER 4
GEO-DEMOGRAPHIC ANALYSIS

St. Petersburg College

This chapter presents the geospatial analysis of St. Petersburg College. Having introduced the history and importance of both geography and institutional research and described how the tenets of Business Geography can relate to current issues higher education, this chapter will discuss the core analysis of this research. The study exemplifies the use of GIS in education planning. The chapter is organized as follows: first, information about the organization, history and mission of the college will be discussed. Secondly, the analysis completed for the college will be detailed along with an extensive appendix of figures and maps. Lastly the summary findings for the study will be listed and discussed.

Organizational Structure

St. Petersburg College (SPC) is located in Pinellas County, Florida and offers services throughout the county from various campuses and service locations. Geographically, Pinellas County is a peninsula with the Gulf of Mexico to the west and Tampa Bay to the east.

SPC is broken down into eleven learning sites throughout the county. The term learning site is used because not all of the sites are considered campuses. According to Stan Vittetoe, the VP of Business Operations for St. Petersburg College, a campus must offer services that include student services, libraries, counseling, bookstore, ect. (Phone interview with Stan Vittitoe, Vice President of Economic Development, on October 9th, 2006) Four of the eleven learning sites are considered campuses. The four campuses include St. Pete Gibbs, Tarpon Springs, Clearwater, and Seminole along with the rest of the learning sites can be seen in Figure 4-1.

The administrative organization the college has a Board of Trustees that is a political sub-division of the state and part of the state community college system. The Board governs the

college as a whole. The president of the college is the secretary of the Board and is charged with the day to day operational management. A Provost, Vice President, or an Executive Officer supervises each campus or learning site.

Historical Development

In 1927 St. Petersburg Junior College opened as Florida's first two-year institution of higher learning. The college was based out of a wing of the new St. Petersburg High School. The initial enrollment was 102 students with a faculty of 14. Historical dates for the development of the college are listed below.

- 1931 Gained full accreditation
- 1948 Private college became public
- 1965 SPJC merged with African-American Gibbs Junior College
- 1990s SPJC occupied a dozen sites throughout the county
- June 2001 SPJC became St. Petersburg College, a four-year institution
- August 2002 SPC began offering fully accredited baccalaureate programs (SPC 2006)

Values

According to the information found on the college website the purpose of the college is to provide access for:

> Students pursuing selected baccalaureate degrees, associate degrees, technical certificates, applied technology diplomas and continuing education within our service area as well as in the State of Florida…As a comprehensive, multi-campus postsecondary institution, St. Petersburg College seeks to be a creative leader and partner with students, communities, and other educational institutions to deliver enriched learning experiences and to promote economic and workforce development.
>
> (http://www.spcollege.edu/webcentral/catalog/Current/mission_goals.htm)

This research has significance for SPC's mission statement because of the ability to use geospatial tools to geographically organize data related to student profiles, community characteristics, and other institutions that will assist in promoting economic and workforce development.

St. Petersburg College Analysis

Focus of Analysis

This study evaluates the geo-demographics of St. Petersburg College (SPC) in order to address specific and general questions for the benefit of the college. Geographically, SPC effectively serves the entire Pinellas County with higher education. This analysis draws attention to opportunities for SPC to increase market penetration within the county by greater targeting of particular population segments which are identified in this report. Also, several geographic areas warrant monitoring due to high population growth, and the services provided are not increasing in proportion to the population change. These geographic areas are identified within this report.

This analysis completed for SPC is broken down into five sections. The five sections are described below.

1. Data – A description where the data came from and what needed to be done prior to analysis
2. SPC Objectives – A discussion of some of the outlined one and three year objectives of the college.
3. Trade Area Assessment – An overall look at the trade area of SPC and some underlying patterns and observations.
4. Market Penetration – An assessment of the proportion of the population captured by the college
5. Program Need – A look at industry and education indicators that may affect SPC planning.

Data

The data tables for this analysis include the fall 2005 student enrollment for St. Petersburg College, as well as current demographic data tables for Pinellas County. The student information was provided to Dr. Grant Thrall by SPC. Prior to commencement of the analysis, Dr. Thrall restructured this database to be in a GIS (geographic information systems) suitable

format. The restructured database includes age, sex, race, and credit earned by campus. Geo-coding is the process of converting address data into spatial data that can then be used for GIS analysis. The student addresses included in the database were geo-coded to enable geo-demographic analysis. Once the addresses were geo-coded they were deleted along with any other personally identifying information. The data table reports were provided by Professor Thrall in the summer of 2006. Tables 4-2 and 4-3 show the distributions of the age and race of the fall 2005 SPC students, tabulated by the students' home campus and by degree sought.

The demographic data for the Pinellas County area was also provided by Professor Thrall. Through the use of a site license for ESRI's Business Analyst demographic data was obtained. Using this technology all of the student data records were assigned lifestyle segmentation profiles (LSP) which are used in the analysis. This analysis also integrates SPC objectives with the previously documented data tables (Kuttler 2006).

SPC objectives: In the fall of 2006 Dr. Grant Thrall introduced the St. Petersburg project to his seminar in business geography course. Collaboration with SPC's Vice President Stan Vittetoe allowed for the refinement of project objectives. Recently the college had been experiencing a decline in enrollment and thus SPC was interested in the type of services geospatial analysis could provide to the college in the form of consulting. A descriptive and analytical geo-demographic consulting project was undertaken in an effort to assist SPC.

During the preliminary stages of the research project a proposal was put together for review by the college. The proposal was developed partially from ideas taken from the St. Petersburg College 2006-2009 Strategic Directions and 2006-2007 Institutional Objectives (Kuttler 2006). The objectives and strategic directions outlined by the college early in 2006 all have assigned priority designations, with one being the highest priority and five being the lowest.

In the proposal development stage an intention of the class was finding SPC objectives that were both high priority and approachable from a geo-spatial perspective. Figure 4-2 shows an example of the college objectives that are focused on in this analysis.

Trade Area Assessment

Section I

In order to get an overall idea of where the students are coming from the analysis requires assessment of the trade area. The trade area can be described as an area encompassing 80% of the customer base (Thrall 2002). In a community college this standard can be applied, but in the case of SPC the trade area is bound by the Pinellas County boundary. Conversations with SPC administration determined that the community college system in Florida prohibits SPC from marketing outside of Pinellas County. Using this constraint the analysis for of this research project is for the most part limited to Pinellas County. Of the 22,456 students included in the database tables provided for the project, 18,035 are identified as having an address within Pinellas County. Coincidentally, the Pinellas located students represent approximately 80% of the total student population which is the same benchmark used in business geography.

Section II

In this section of the analysis student geographic distribution, drive time analysis, age distribution of students and psychographic composition of enrolled students will be examined. Based on these measures a better understanding of the population of St. Petersburg College students can be developed as well as an understanding of what can be done by the college to better represent this population.

The majority of SPC students reside within the Tampa Bay area, most within Pinellas County, but many throughout the State of Florida. Figure 4-3 shows the home address of every SPC student. The learning sites are represented by a different color dots and the site that the

student takes the most credits from determines the color of their dot. The online campuses have the potential to draw from areas outside Pinellas County. Moreover, online offerings can serve to attract more Pinellas County residents to SPC. SPC online students are for the large part clustered around Tampa Bay. Distant students might be registering with their parents' addresses, versus their own near campus address. Figure 4-3 shows the extent of the student enrollment and reveals potential for marketing and recruitment from various clusters within the state.

Student geographic distribution within the boundaries of Pinellas County was evaluated by dividing the county into 1.5 kilometer cells. The number of students within each cell was calculated. Figure 4-4 shows student geography within Pinellas County. The darker colored and elevated cells have more students than the lighter lower cells. The geographic distribution of SPC students is clustered in the southern perimeter of the county, with SPC serving fewer students in the northeast. Also, areas of the southeastern region of the county shows enrollment dropping to below 50 students per 1.5 KM cell. These areas may be commercial, and the database did not include addresses for place of work.

There is a strong correlation between enrollment of students and proximity to the campus. SPC does well in enrolling students within close proximity to the campus. Online students however show greater geographic dispersal of home addresses than traditional campuses. Figure 4-5 shows student enrollment separately for the Tarpon Springs and Clearwater campuses, by ZIP code. The Seminole and online enrollment are shown in Figure 4-6. Each area of the county is revealed to be well served by at least one of the SPC campuses, with the exception of the northeast. The northeast is revealed to be part of the Tarpon Springs trade area, but comparatively few students are enrolling at SPC from this area.

An integral component of the community college mission is providing unrestricted access for citizens within the community (Brawer 2003). Access is directly rated to the cost of transportation and increased distance equals increased costs for students. Because contemporary transportation effectively requires commuting by car, analysis of drive times to each campus is important for mitigating the costs of transportation and improving access. Figure 4-7 shows drive time zones around each SPC learning site or campus. Each of the irregular polygons shows the distance a person could drive in seven minutes from the campus. The software used for this graph allows the user to determine the drive time and the speed of travel before creating the polygon. Once the zones were created the number of students living within these seven minute zones were tabulated. Approximately 35% of the total Pinellas County enrollment lives within seven minutes of a learning site or campus. Seven minute zones were used here because more than seven minutes would create overlapping zones that would be less visually effective difficult to analyze. If the college were to continue with this reasoning, prospective new campuses would be located at Palm Harbor, Dunedin, or Western Clearwater.

According to the population growth estimates included in the database provided by ESRI's business analyst each of the ZIP codes of Pinellas County will see an average increase of 144 people between the ages of 15-45 by the year 2010. Approximately 92% of SPC students fall into the age group 15-45 (Table 3-1). Some ZIP codes will see an increase of up to 430 people of the targeted group, college age population. The greatest estimated growth will be in the northern part of the county served by the Tarpon Springs campus (Figure 4-9). Throughout the analysis Market Segments of Potential Opportunity (MSPOs) are identified. Figure 4-9 has a reference to zip codes that are designated in this reference as MSPO. The color ramp used in

Figure 4-9 is also used at various times in this analysis. The traffic light pattern of green and red was chosen to designate the highs and lows, or hot and cold areas of the county.

According to Dr. Carol Weideman, Director of Institutional Research at St. Petersburg College, there has been a gradual decrease in high school age population enrollment at SPC (Interview with Carol Weideman on March 6th, 2007). Figure 4-10 shows a high school age population projection from 2005-2010 for Pinellas County. These areas can be targeted for recruitment to perhaps reverse the trend recently experienced by SPC. The percentage scale of projected change for the county's high school population is -25% to +30% broken down by zip codes. By multiplying the numbers of current population in the age group 10-15 by the projected growth per ZIP code the projections were developed. The northern part of the county will have the greatest growth of high school aged population, while the central county is projected to have decreasing numbers of high school age population. SPC does not capture a high number of students from the Northeast corner of the county while at the same time the analysis shows the growth rate of high school age population as high in the northeastern area (Figure 4-11). The northeast is a target of opportunity for SPC.

Being an older, more established, and densely populated area, Pinellas County is not projected to have as great a percentage of population change as surrounding counties. Nevertheless, the change in demographic composition of the county will significantly affect SPC. Pinellas County is a desirable destination, therefore it is reasonable to expect an ongoing process of densification in the county. Because of these factors examination in the overall population trends throughout Pinellas and the surrounding counties is important (Figure 4-12). On average, each ZIP code within Pinellas County is expected to increase in population 0.5% during the next five years annually. Figure 4-12 illustrates that the greatest increase is expected

in ZIP code 34688, bordering Pasco and Hillsborough Counties; ZIP 34688 has an expected estimated growth of 4.5%. Both Pasco and Hillsborough Counties will experience high growth rates, particularly in areas adjacent to Pinellas County. While Pinellas County may be an effective trade area for SPC, SPC can better serve the state's population by carrying some of the burden of student enrollment in nearby adjacent areas. The adjacent areas shown in Figure 4-12 are MSPOs.

Student demographics were also analyzed using market segmentation profiling. The reasoning of market segmentation profiling is that people with similar tastes, lifestyles, and behaviors seek others with the same tastes. These behaviors can be measured, predicted, and targeted (Thrall 2002). By examining these profiles with student data, we can better understand the economic landscape that SPC must draw their students from.

Lifestyle Segmentation Profiles of SPC students were calculated using ESRI's Tapestry LifeMode groups (ESRI 2006). Figure 4-13 shows ZIP codes color coded to dominant LifeMode group. LifeMode groups can be further decomposed into 64 more detailed segments (Figure 4-14). SPC trade area has 17 ZIP codes dominated by the LifeMode group Senior Styles, which is comprised of Rustbelt Retirees, Senior Sun Seekers, The Elders, and others.

The majority of SPC students are from areas with aging populations. Projections indicate that the recent trend will continue over the next five to seven years. However, Figures 4-13 and 4-14 document that some areas within the SPC trade area are dominated by younger households with college age students that are potential SPC students. Examples of MSPO are high hopes, young and restless, solo acts, metropolis, great expectations, global roots. Figures 4-13 and 4-14 shows the locations of MSPO. By understanding the differences in these groups and knowing

the locations of these areas, SPC management can better understand their trade area and develop recruitment strategies to appeal to their desired segment.

The study also sought evidence of clustering of specific socio-demographics by campuses. This question is addressed by producing a series of spider maps (Figures 4-15, 4-16). Spider maps draw lines from the students' residence to their respective campuses. Almost 75% of all SPC students are contained within only four lifestyle segmentation profiles (LSP). LSP 5, or "senior sun seekers", makes up 32% of the total enrollment. These students are classified as the senior population based on income, age, and housing type. LSP 10, or the "traditional living", makes up 20% of the enrollment. This profile is classified as middle aged, middle income – middle America. LSP 7, or the "high hopes", makes up 14% of the enrollment and is classified as young households striving for the "American Dream". Lastly, LSP 1 students, or, the "high society" makes up 7% of total enrollment. This profile is classified as affluent, well-educated, married couple homeowners.

After analyzing these student profiles and their respective campuses, it is difficult to identify significant clustering within the largest LifeMode group, Senior Styles. The senior sun seekers are enrolling at campuses throughout the county and there is a group that travels beyond their closest campus. This could be explained by the offerings of certain majors and classes at specific campuses. Clustering increases as the percent of enrollment from LSPs decrease.

Market Penetration

Capture rate is defined as the percentage of the total college age population enrolled at St. Petersburg College. The market penetration section of the analysis shows the student capture rate throughout county as well as the minority capture rate, age group capture rate, and the gender capture rate. For this analysis the market penetration capture rate is assessed by zip code. SPC enrolls from five to six percent of the college age population in 17 of 47 ZIP codes within

the county (Figure 4-17). The average capture rate is 5.4% throughout the county. Two ZIP codes that fall into the MSPO classification are 33760 and 33762 and both capture roughly 3% of the college age population. SPC captures a high of seven to eight percent in the two northernmost ZIP codes. The analysis shows that the total numbers of students attending from this area is small but relative to the small number of college age population in this area, SPC does relatively well enrolling students from this area.

Higher education strives for racial equality and public institutions value equivalent representation amongst the population. SPC's institutional objectives and strategic directions illustrate the importance for improvement in ethnic representation at the college (Figure 4-2). Capture rate analysis is performed to evaluate the success of SPC of enrolling an equivalent ethnic representation throughout the SPC trade area. Capture rate analysis differs from simple race percentages in that capture rates compare the percent of students' enrollment from each race in a ZIP code to the percent of the actual population of each race in a ZIP code. Capture rate analysis reveals if a race is under represented, or overrepresented. The traffic light style color ramp used in Figures 4-18 through 4-21 does an effective job of displaying under-represented (red) ZIP codes to those that are very close equal (neutral) and the over-represented areas (green).

Figure 4-18 shows the college capture rate for black populations. Most of the ZIP codes fall within the -2.5 to 2.5 classification. The histogram shows a high frequency of zip codes near zero, which indicates an equivalent representation by SPC throughout the county. Figure 4-18 also shows the ZIP codes that are over-represented, and only two have 5-10% more blacks students enrolling. One ZIP code, 33760, is identified as an MSPO because the ratio is approximately -12% here.

According to the analysis the Asian populations are also proportionally represented at the college (Figure 4-19). The ratio scale in Figure 4-19 varies from -1.5% to only 1.5% so throughout all zip codes the Asian population is enrolling equally. Although there is little variance for the Asian population Figure 4-19 does show the areas for improvement within Pinellas County.

The Hispanic population analysis reveals four MSPOs (Figure 4-20). These four ZIP codes fall within the -4% to -5.5% range. Overall the county has 19 orange and red zip codes which indicate a limited proportion of Hispanics in total enrollment. Figure 4-20 can give administrators at SPC an idea of where to emphasize effort for increasing Hispanic enrollment.

The last racial group analyzed was the White race (Figure 4-21). Of the four groups examined, Whites are the least proportionally represented at SPC. The majority of the ZIP codes are red and orange and a few zip codes (MSPO) are in the -10% to -15% range. One notable observation is that the only ZIP code, 33760, that has a greater proportion of whites enrolling at SPC than are living within that ZIP code is also the ZIP code that had the worst representation amongst the black population. This is an issue that warrants further examination by institutional researchers at SPC.

Figures 4-18 through 4-21 reveal that White and Hispanic populations were more extreme in rates of capture compared to Blacks and Asians. SPC is doing a good job in capturing the minority population when compared to each proportional representation of the population by ZIP code. The distribution for the minority capture rate stays fairly close to zero.

The female capture rate throughout the county is an average of about 10% higher than males (Figure 4-22). There are various ZIP codes within Pinellas County that have a 15-20%

higher female capture rate than males. This is especially true in the Southern part of the county. No significant ZIP codes have a higher percentage of males than females attending SPC.

To analyze the distribution of student age across the county, students were partitioned into three age groups (Figure 4-23). The first group, aged 20 and below, indicates a few MSPO ZIP codes with relatively low, zero to seven percent, capture rates. The second age group 20-25 has a similar distribution throughout the county with many of the same MSPOs identified. The third age group 26-45, shows a capture rate of 0-7% throughout all ZIP codes in the county. Even though the mean age for SPC students is 28, the analysis shows that none of the ZIP codes in the county capture more than seven percent of the population in this age group.

Program Need

Program need was also analyzed. Program need is used to describe the current demands for education throughout the trade area of the college. The community college has multiple roles within the community and to best serve these roles an understanding of the types of services in demand is important. This section of the analysis includes looking at education levels and industrial influences throughout Pinellas County. This analysis is important for recognition of where residents of the county have specific educational and program needs. Examination of Figure 4-24 can provide SPC information on where residents of the county are lacking in education and areas where residents have various levels of education as specified by degree level.

Figure 4-25 shows the breakdown of the industries in Pinellas County as well as the number of workers in that industry. Areas with larger circles represent a greater number of workers in that industry and ZIP code. These areas could be targeted to provide industry specific services. An understanding of the influences of industries in the county and where specifically

these industries are located can give SPC management an idea of what programs and courses are in demand.

Summary Findings

Based on SPC's objectives (Figure 4-2), my analysis has revealed locations within Pinellas County where SPC can put marketing and recruiting emphasis (Figure 4-26). Overall conclusions and revealed market segments of potential opportunity are shown in Figure 4-27. The northeast part of the county will have high growth and should be monitored for neighborhood change for timing of a high visibility information center. Demographics in this area are well suited for a community college.

SPC should monitor areas in the central county that have a low minority capture rate. Drive time analysis shows that prospective new campuses or learning sites could be located at Palm Harbor, Dunedin, and Western Clearwater to improve accessibility. An industrial centered campus might be considered as an intervening opportunity for workers in commercial areas in the south central area of the county. Several market segments have been identified by ZIP code according to age, race, gender, capture rate, and major industry that have promise for potential enrollment (Figure 4-26). The following chapter discusses the implications for this study along with possible recommendations for further analysis.

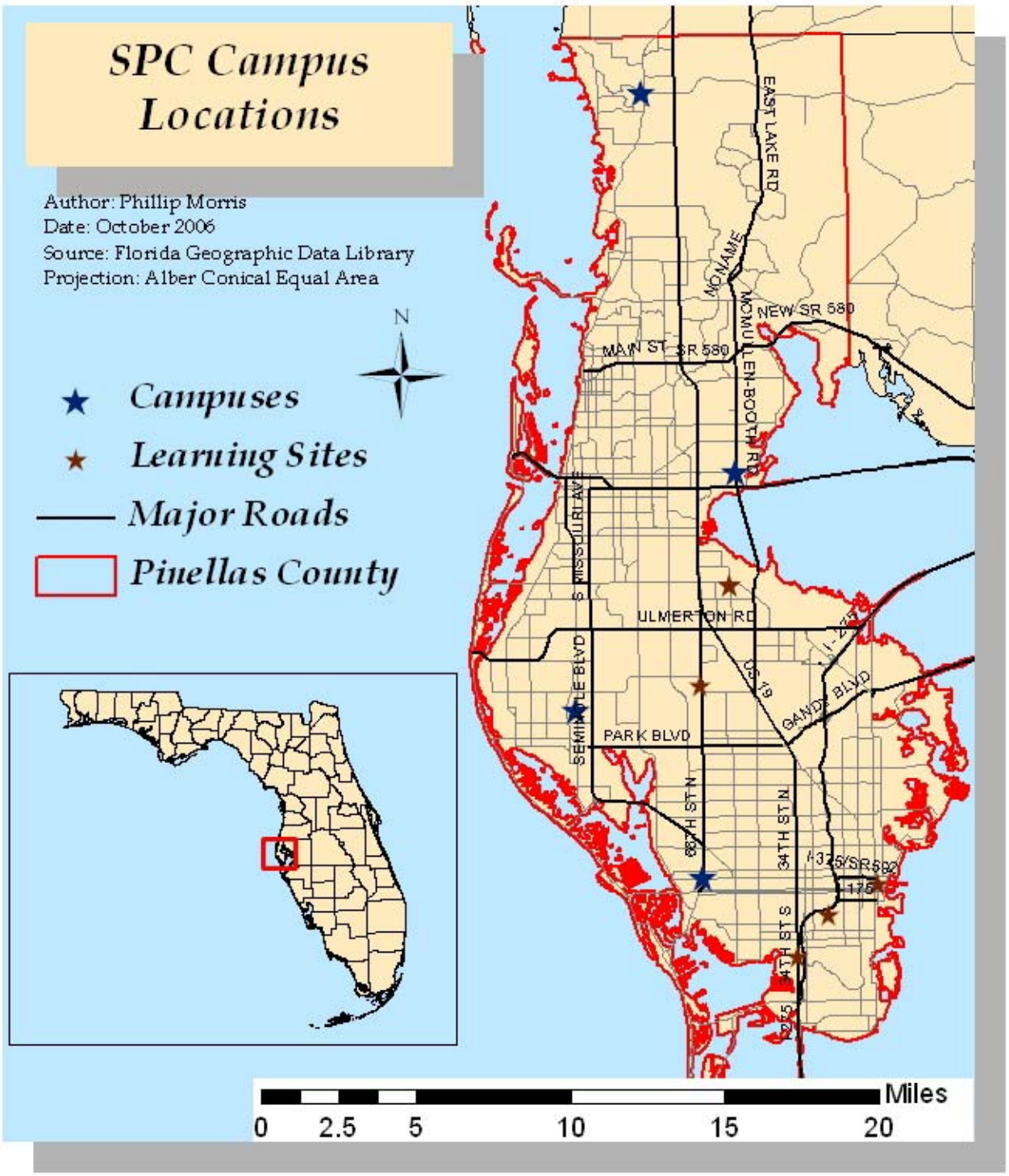


Figure 4-1. Map of SPC campuses and learning sites in Pinellas County

SPC Objectives

2006-2009 Strategic Directions and 2006-2007 Institutional Objectives.

Priority Description Table

Priority	Short Name	Long Description
1	Essential/Mandate/SBE Imperative	Federal, State or SACS mandate; directly supports one or more State Board of Education (SBE) Imperative(s); or contractual obligations.
2	Critical/Academic Mission/Access Expansion	Critical to College's core academic mission; direct impact on academic programs, classrooms, teaching and learning; New initiatives aimed directly or indirectly at enhanced access
3	Supportive/Student Services /Student Activities	Continues, enhances, and/or discontinues an existing support service for students and faculty; includes, for example, counseling, advising, athletic programs, etc.
4	Productivity/ Quality/Organization	Improves productivity or quality, addresses an organizational/staffing issue.
5	Desirable Objective	Desirable and beneficial objective, but may be deferred or carried forward, depending on availability of resources, without adverse impact on College operations.

Objectives Table

2	9. Explore ways to enhance systems and services at SPC that will lead to an increase in Hispanic student enrollment. (June 30, 2006)
2	7. Launch a program to provide collegewide increased support for minority male students. (June 30, 2007)

Figure 4-2. One and three year objectives for SPC. The first table "Priority Description Table" describes what constitutes a level 2 priority, while the "Objectives Table" describes the objective. Both level 2 and are significant in this study.

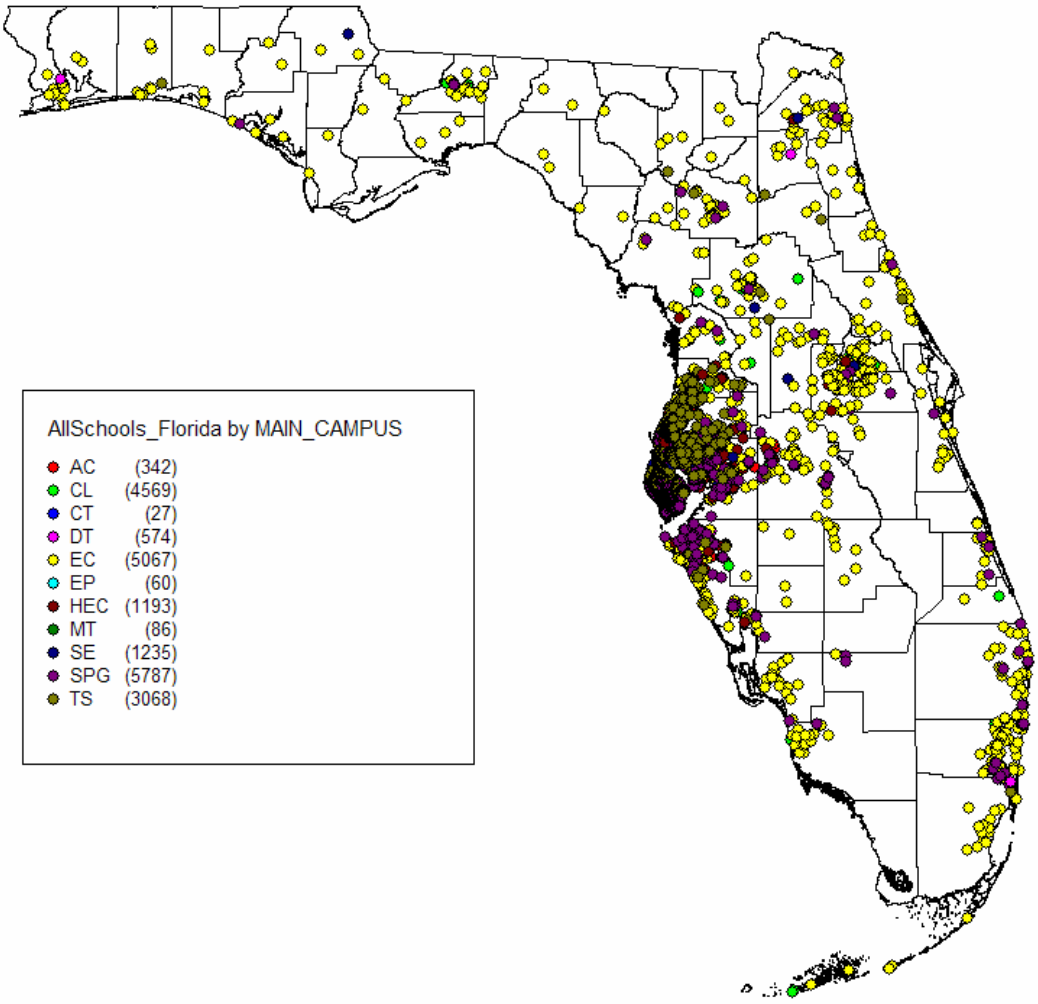


Figure 4-3. Geographic dispersion of SPC college students throughout Florida. Each dot represents the geo-coded address of a SPC student enrolled at SPC in Fall 2005. Yellow dots represent online learning as major campus designation. Distant non-yellow dots likely represent true home locations, whereas the student's campus address is more proximate to St. Petersburg. The color of the dot represents the campuses or learning site the student takes the most credit hours from. The number in parenthesis represents the number of students taking a majority of their credits from that particular campus.

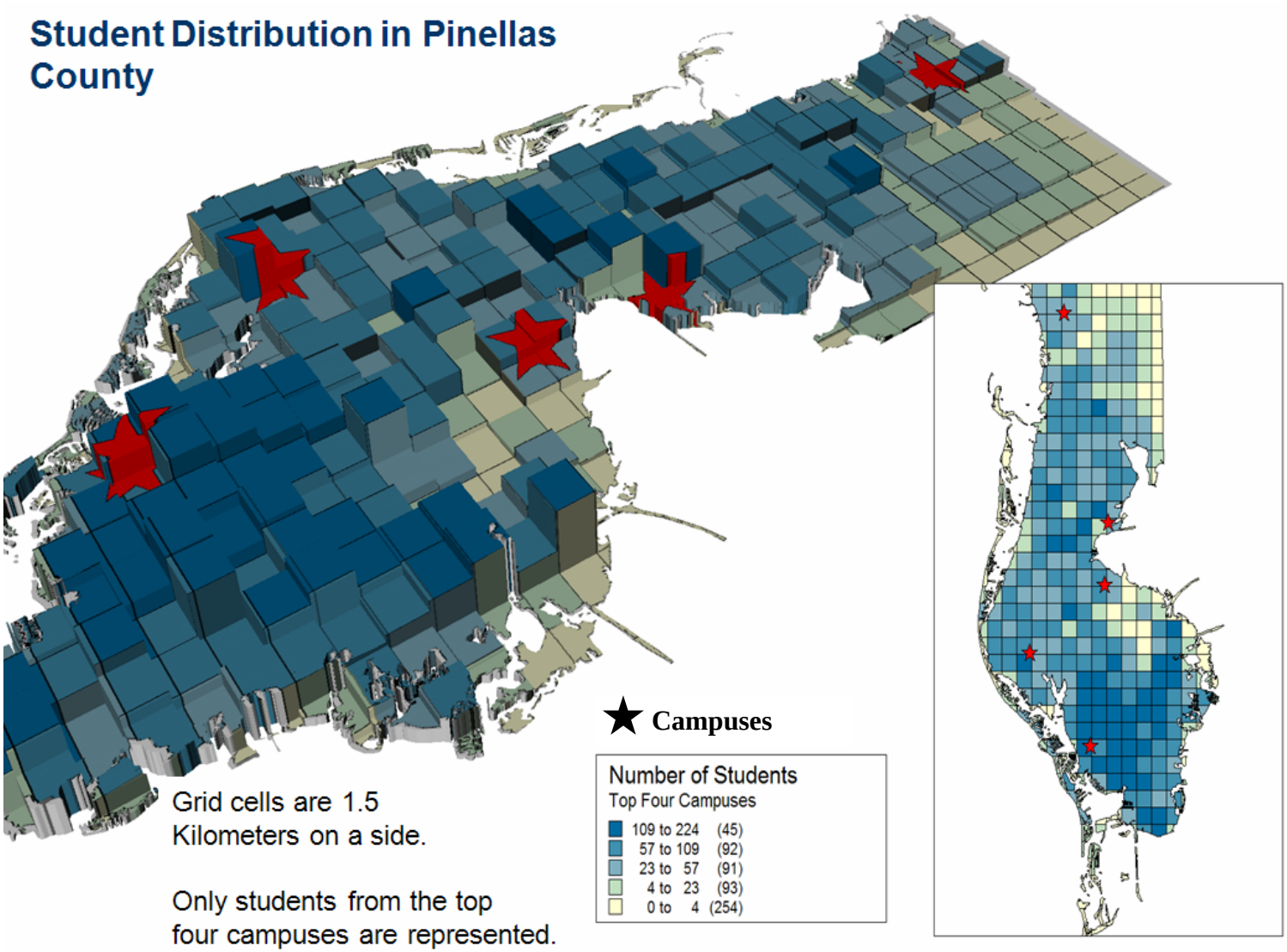
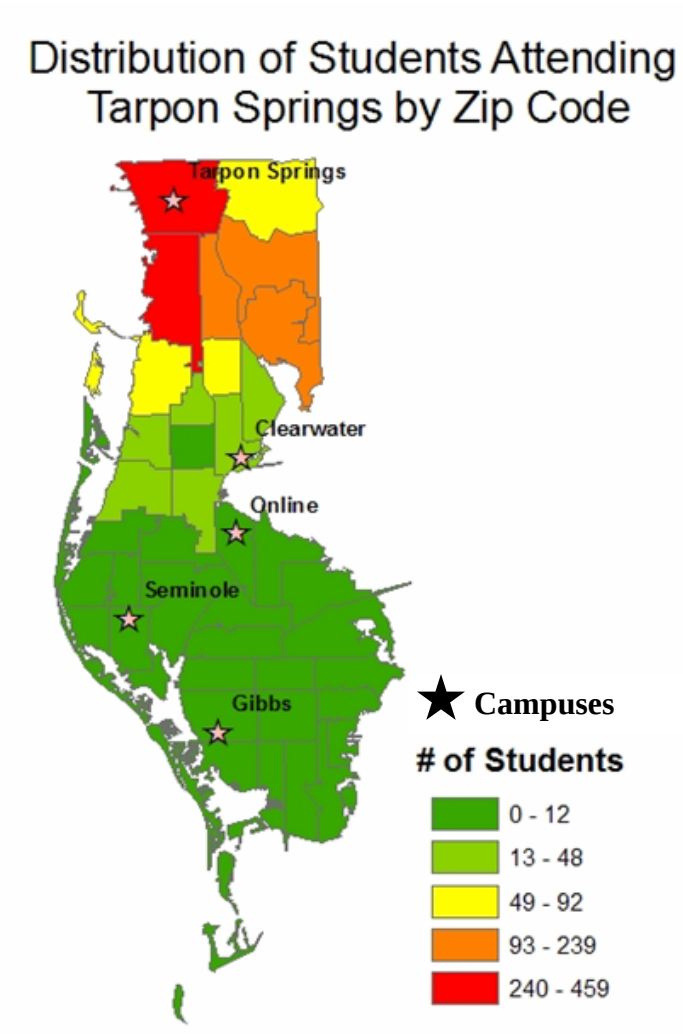


Figure 4-4. Geo-coded address of SPC students living within Pinellas county aggregated to a grid of 1.5KM square cells. The displayed data only includes the students enrolled in each of the top four SPC campuses in Fall 2005



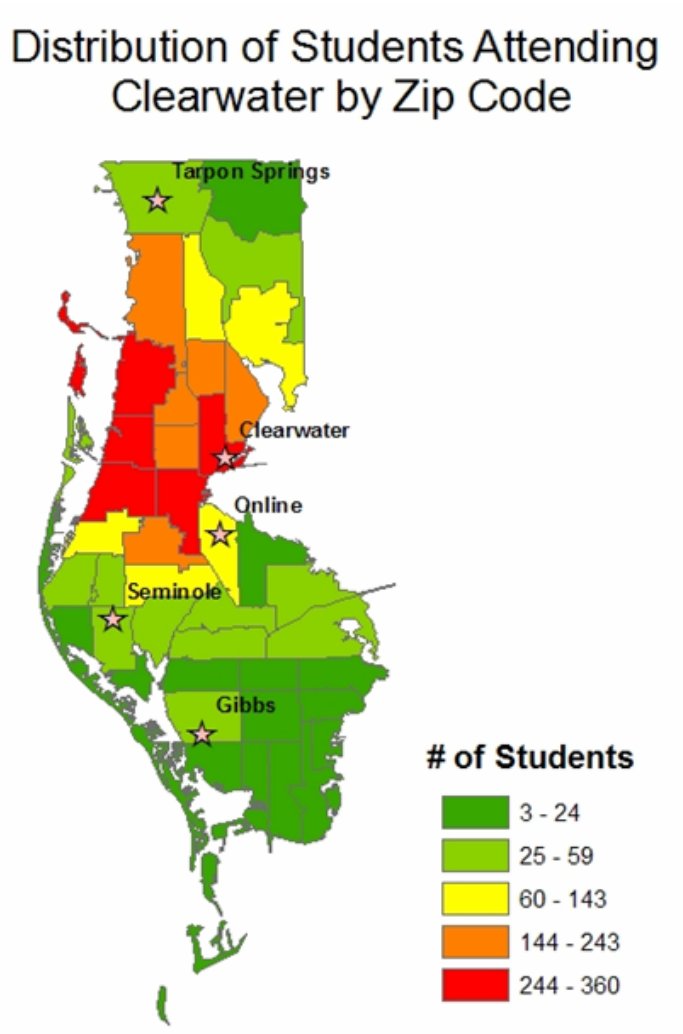


Figure 4-5a. Tarpon Springs and Clearwater campus geographic distribution of student enrollment. The students used to produce these maps are taking most of their classes at that particular campus.

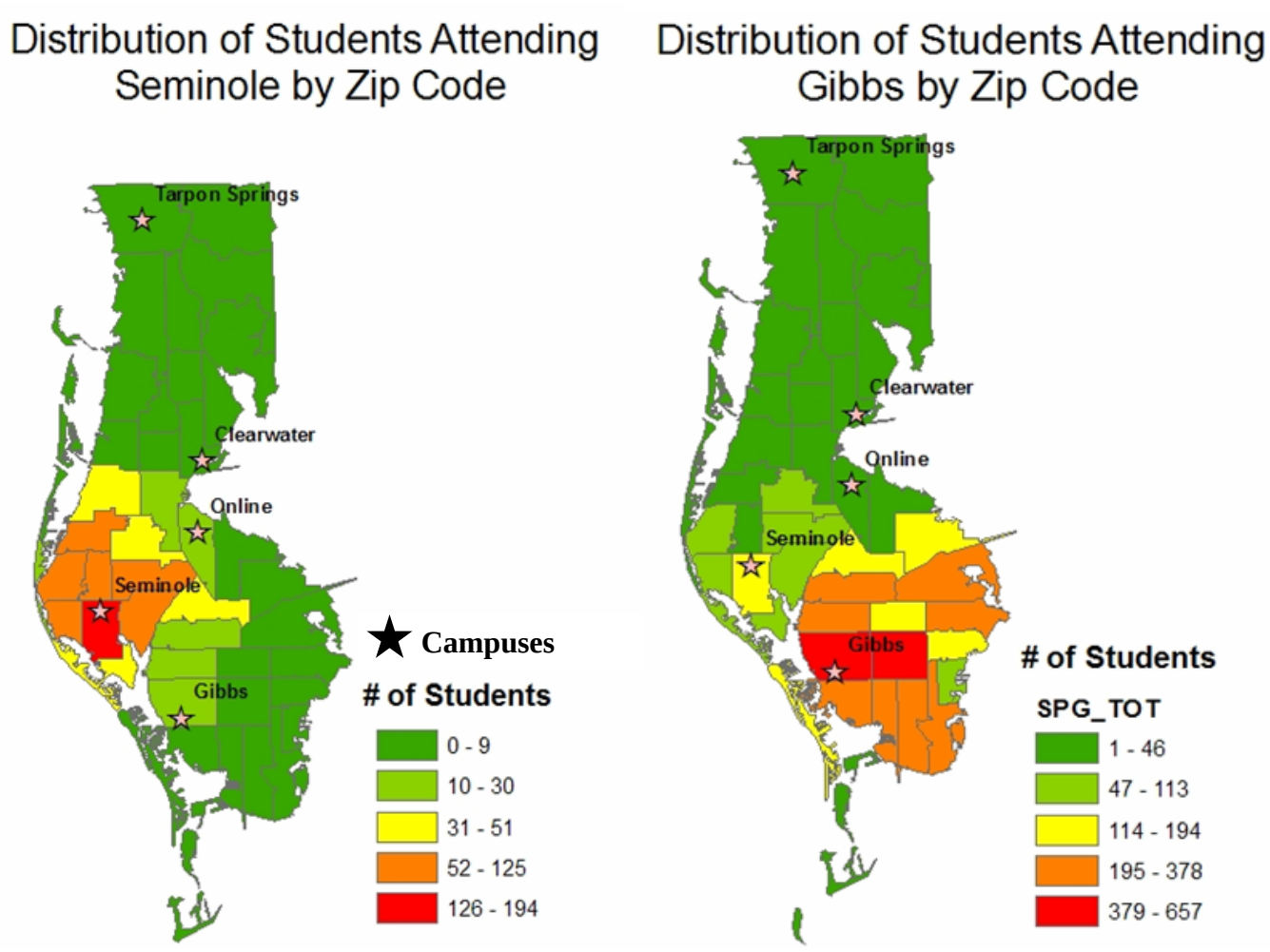


Figure 4-5b. Seminole and Gibbs campus geographic distribution of student enrollment. The students used to produce these maps are taking most of their classes at that particular campus.

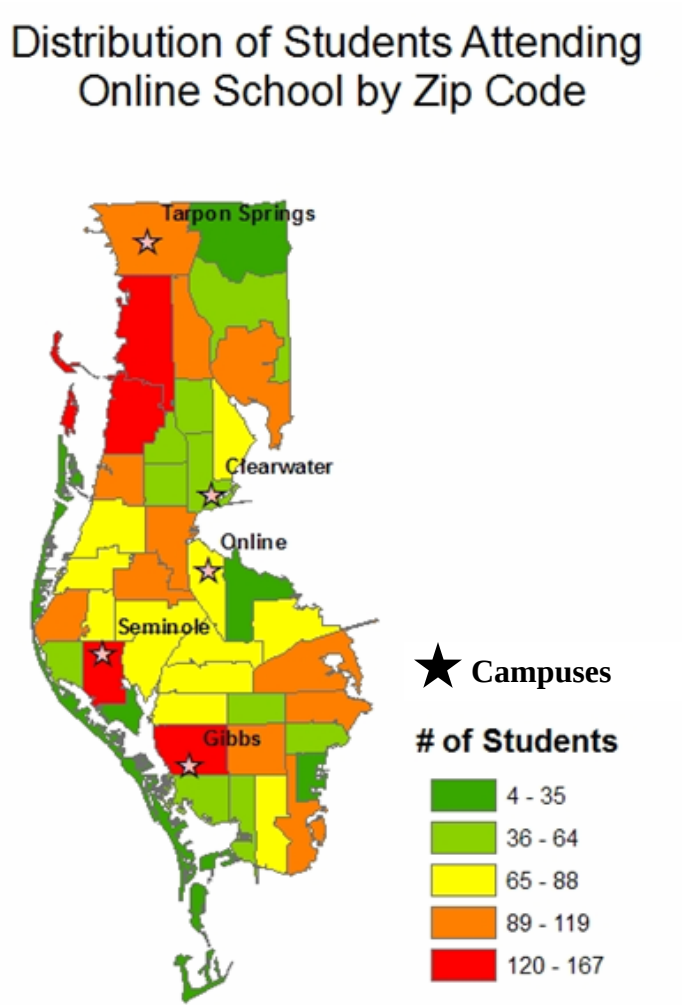


Figure 4-6. Online student geographic distribution. Online students show greater geographic dispersal of home addresses than traditional campuses. The students used to produce this map are taking most of their classes online.

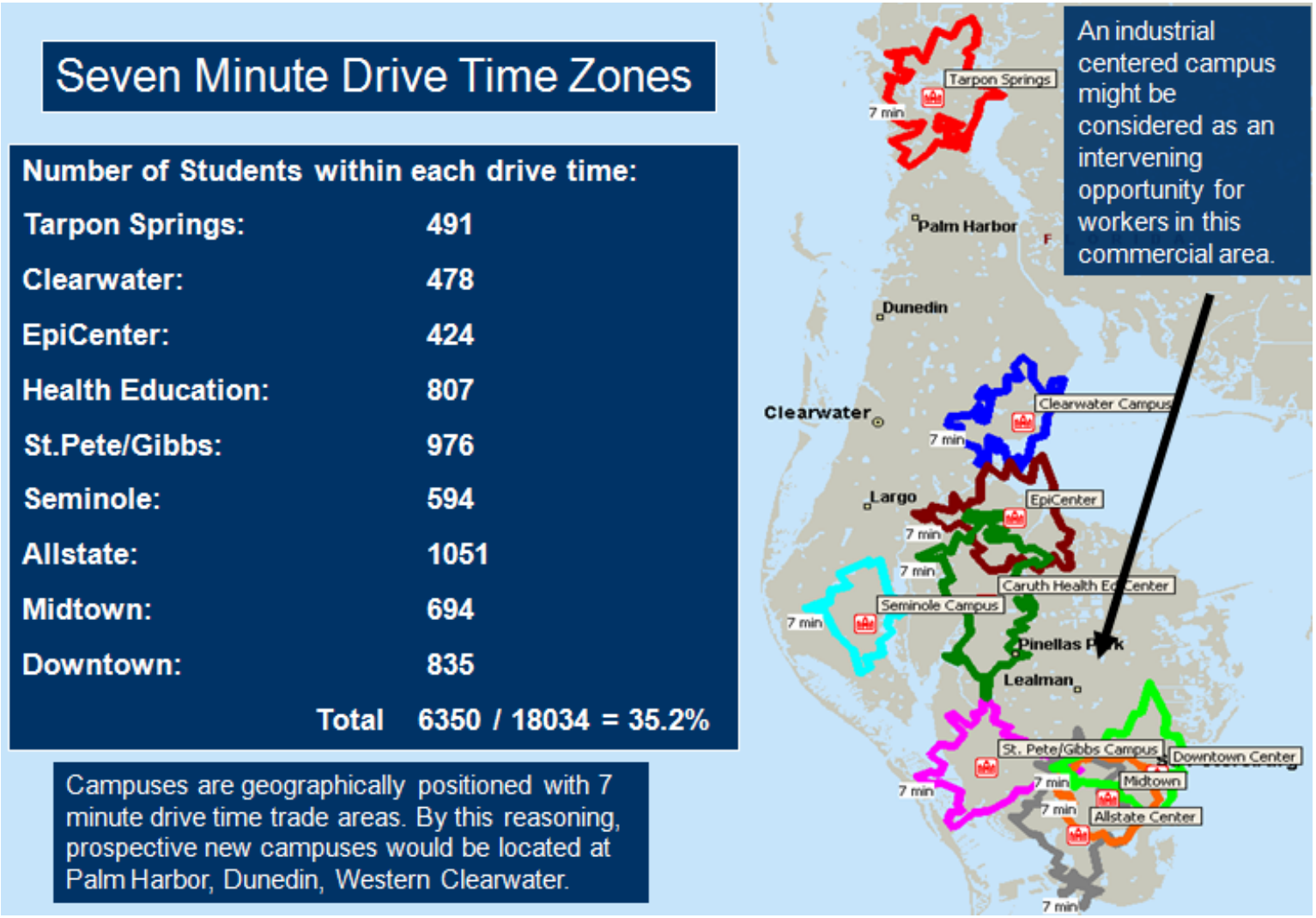


Figure 4-7. Drive time zones for SPC learning sites.

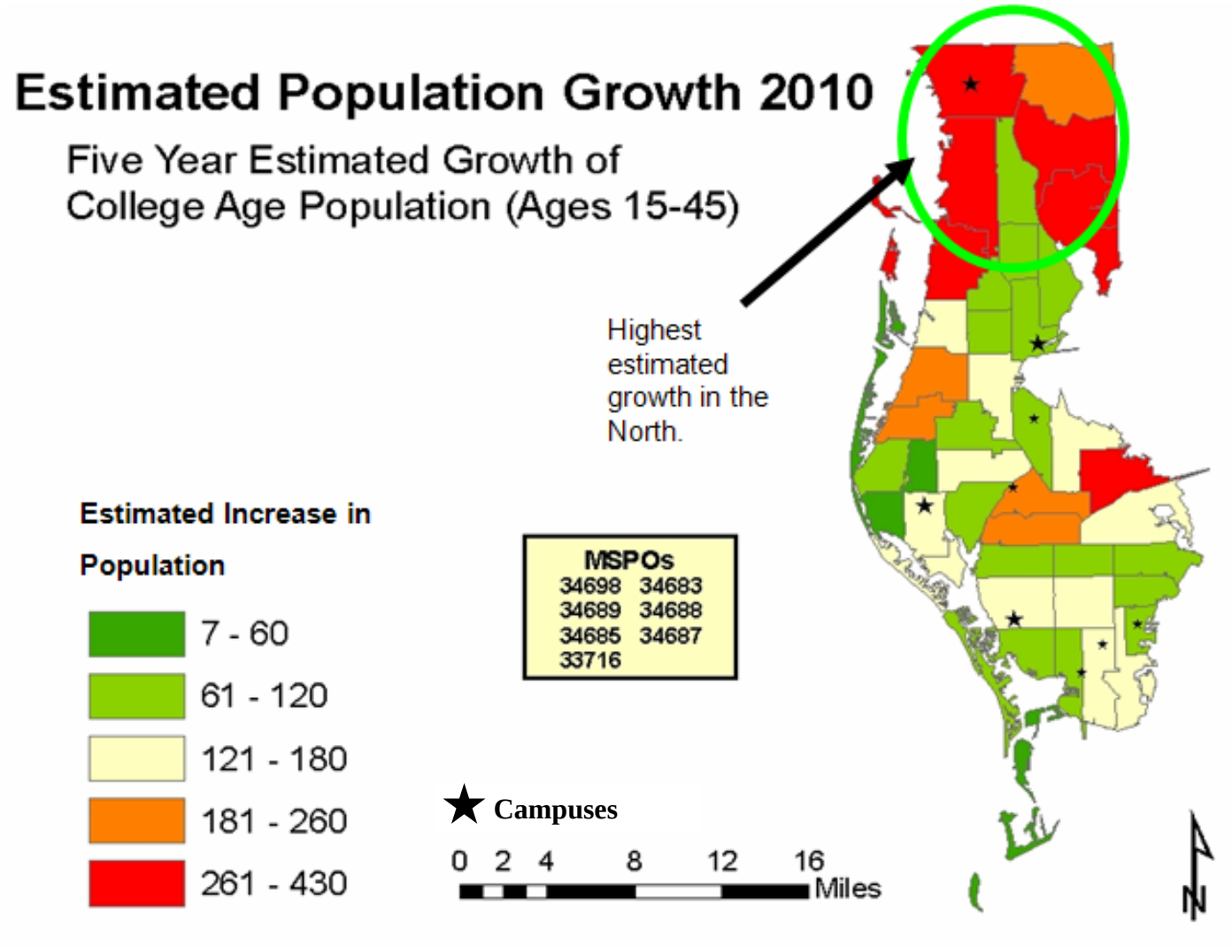


Figure 4-8. Estimated population growth of the college age population within the county.

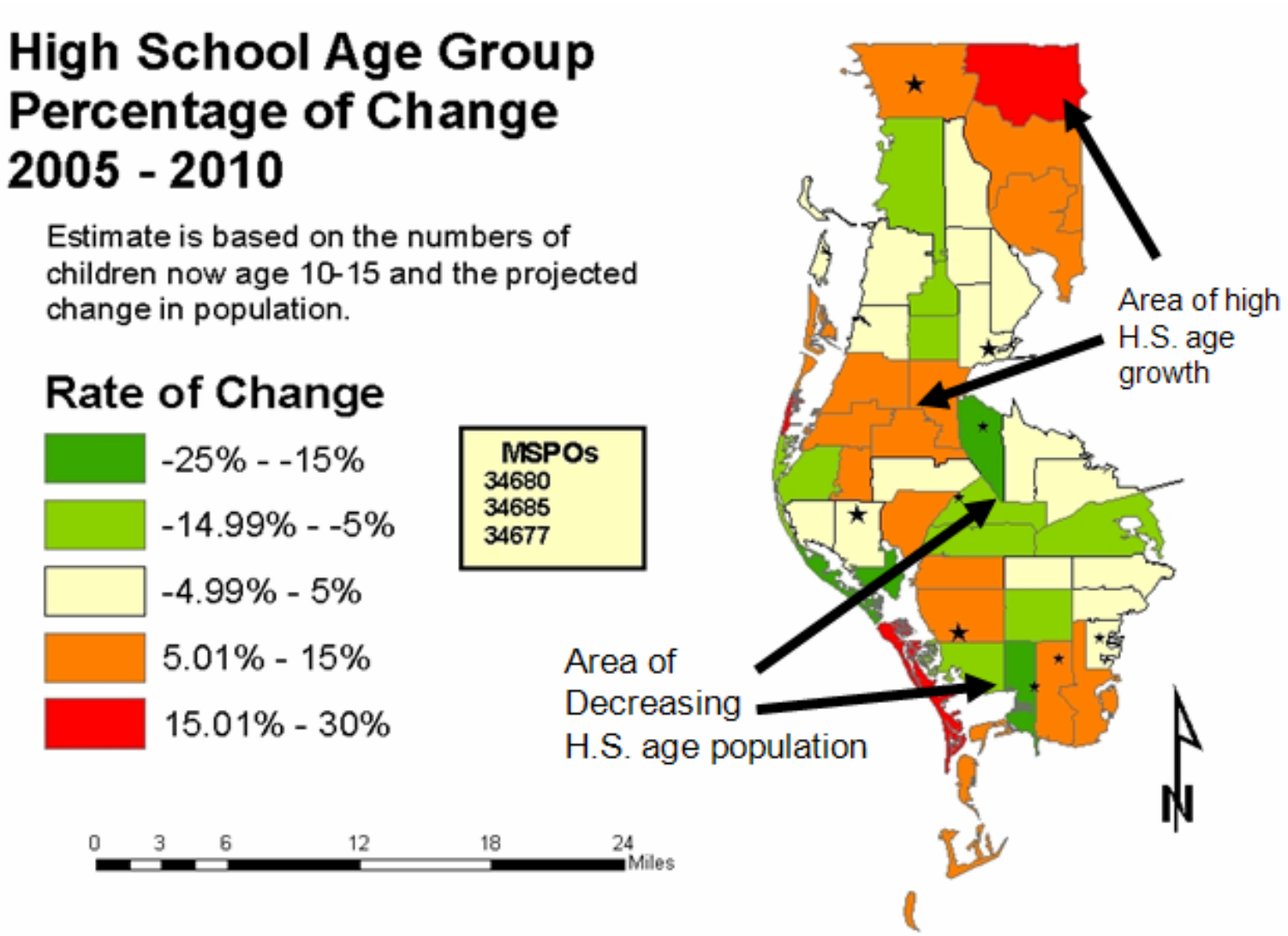


Figure 4-9. High school age percentage of change projection.

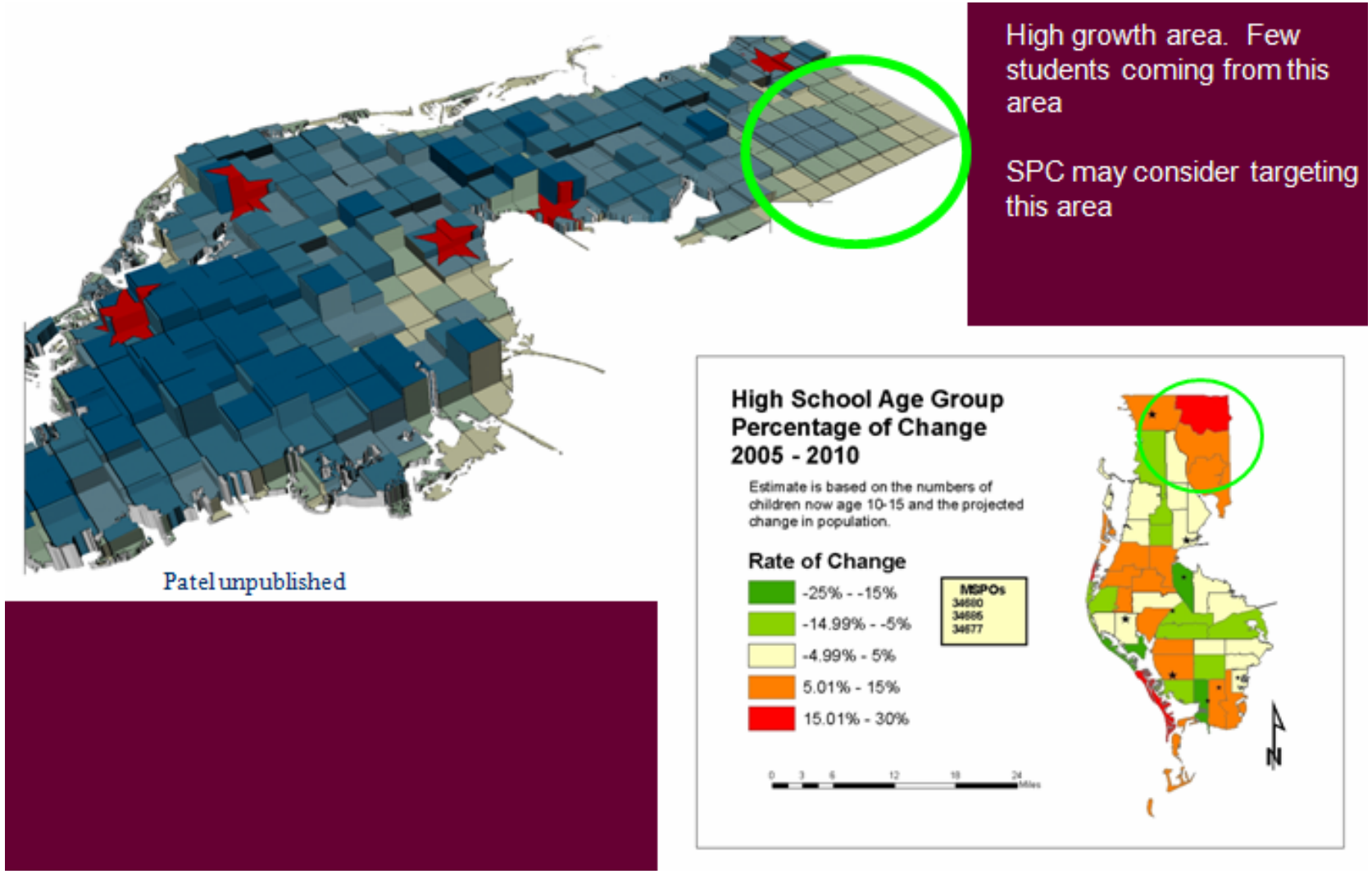


Figure 4-10. Initial consideration of the northeast corner of the county.

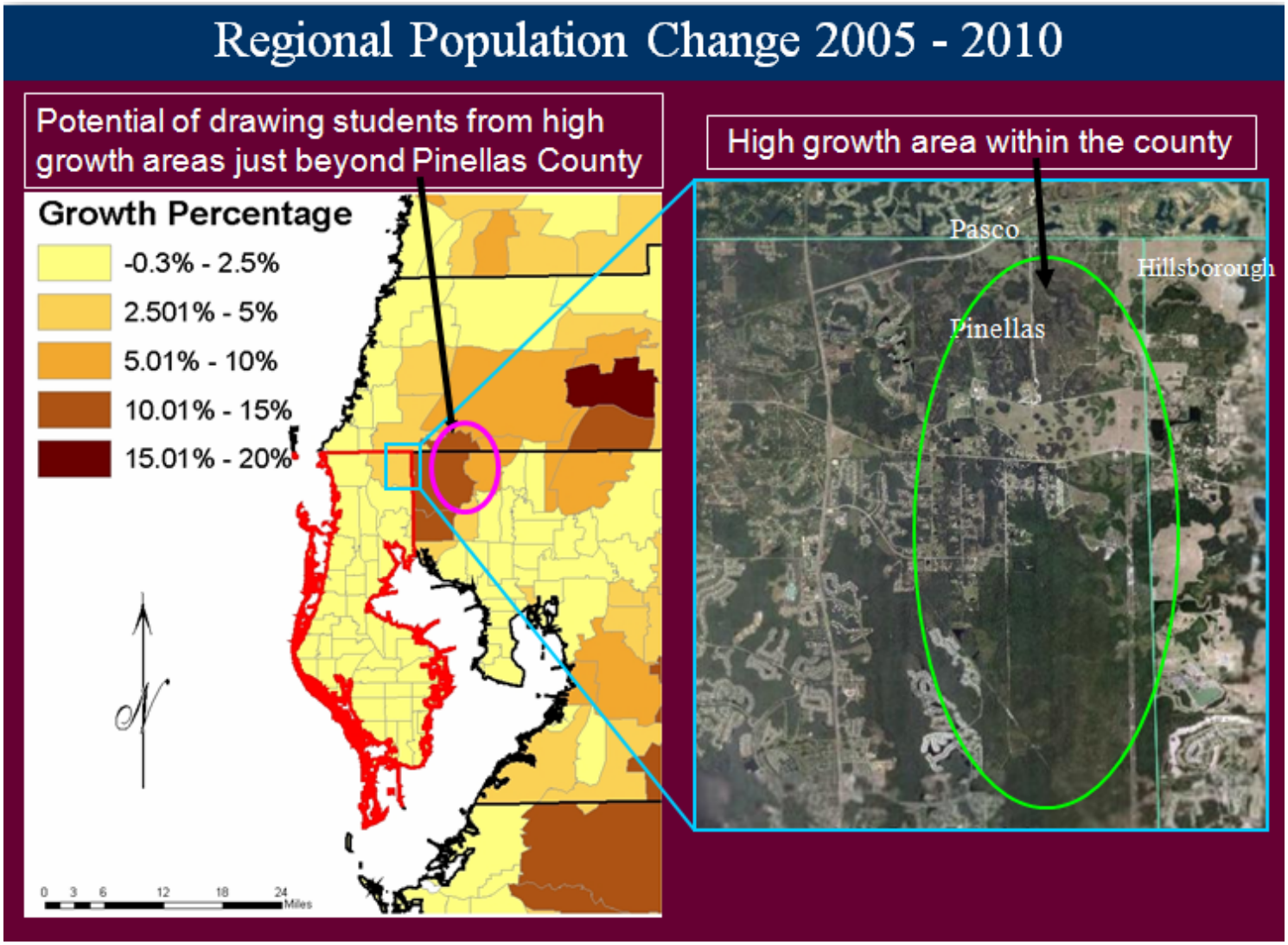


Figure 4-11. Regional population outlook.

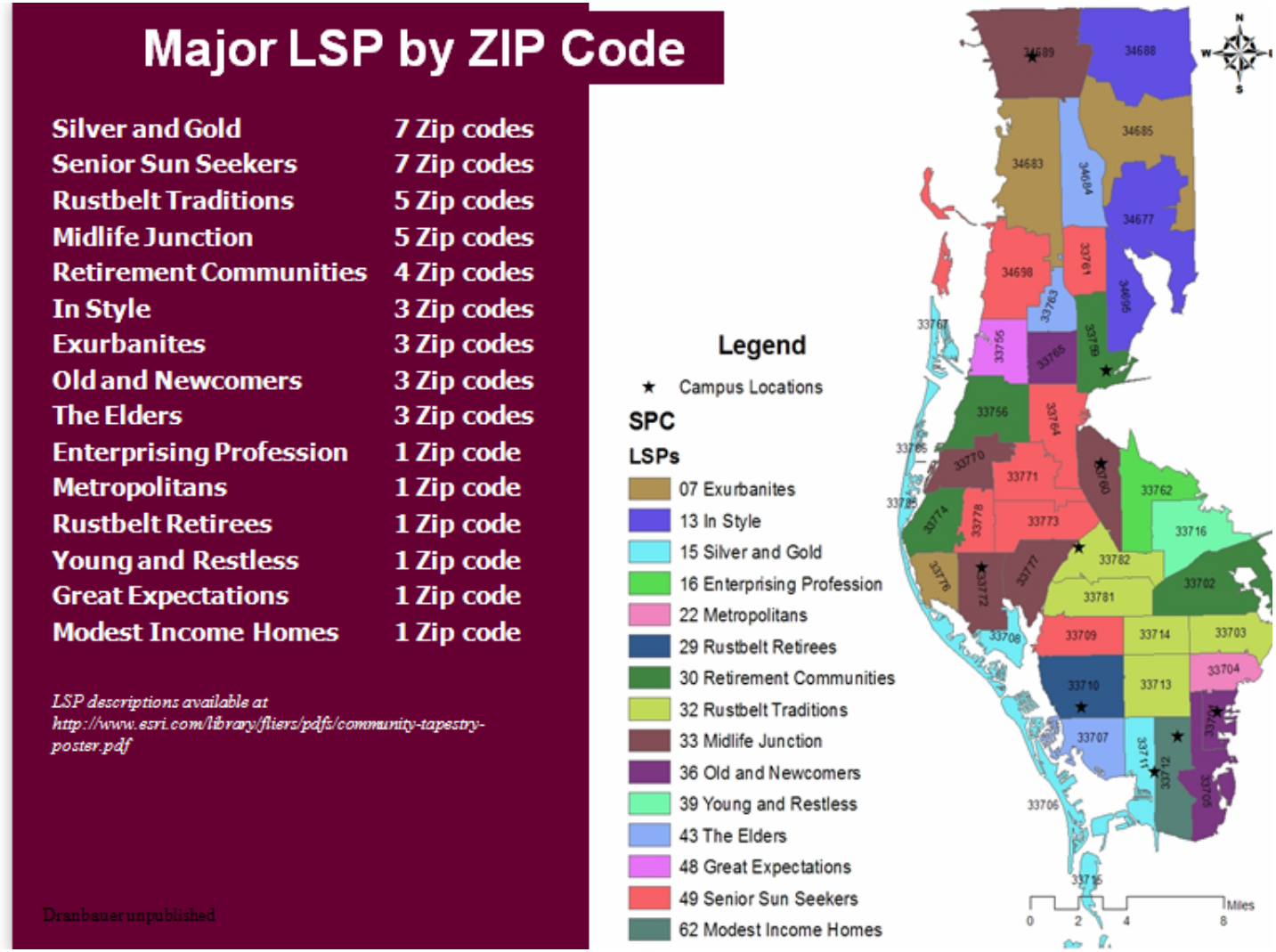


Figure 4-12. Lifestyle segmentation patterns throughout the county.

LifeMode Groups by ZIP Code

Senior Styles — 17 Zip Codes

- Senior lifestyles by income, age, and housing type

Traditional Living — 15 Zip Codes

- Middle-aged, middle income—Middle America

Upscale Avenues — 5 Zip Codes

- Prosperous, married-couple homeowners in different housing

High Hopes — 3 Zip Codes

- Young households striving for the "American Dream"

Solo Acts — 2 Zip Codes

- Urban young singles on the move

Metropolis — 2 Zip Codes

- City dwellers in older homes reflecting the diversity of urban culture

Global Roots — 1 Zip Code

- Ethnic and culturally diverse families

High Society — 1 Zip Code

- Affluent, well-educated, married- couple homeowners

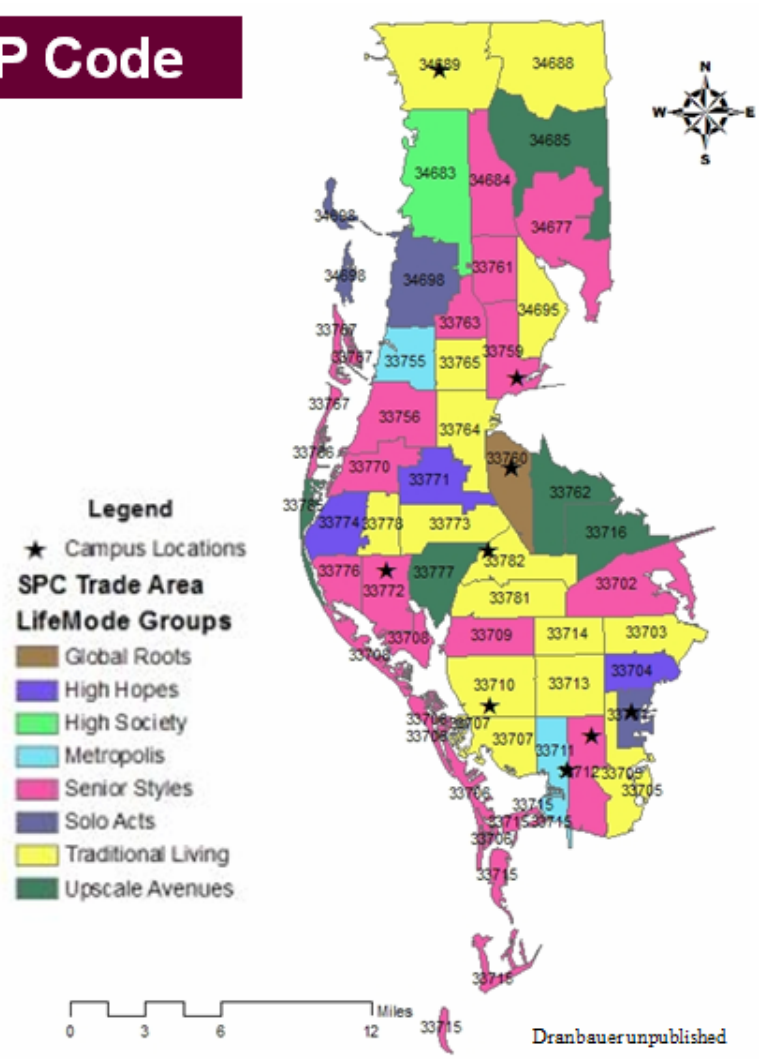


Figure 4-13. Lifestyle group patterns throughout the county.

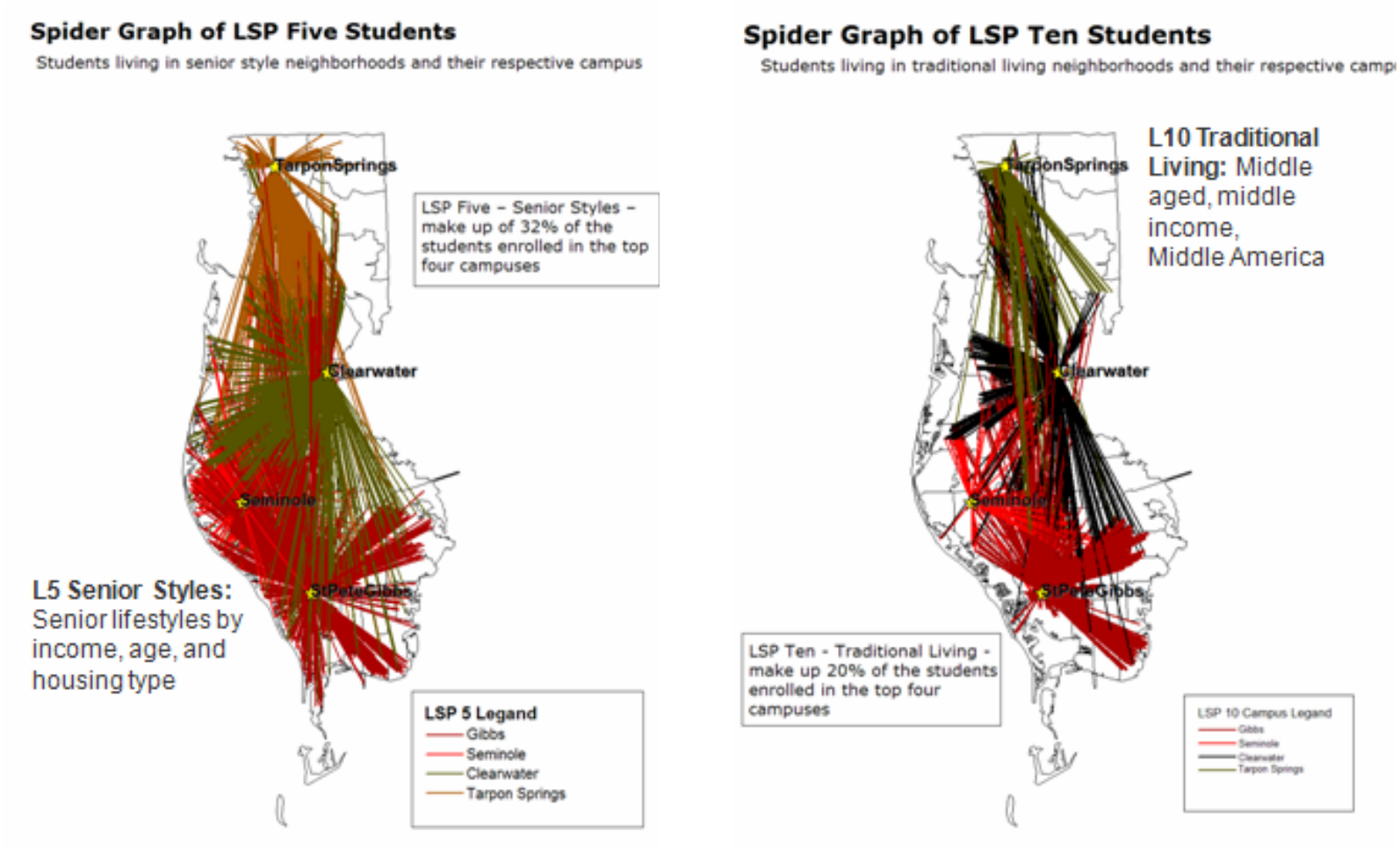
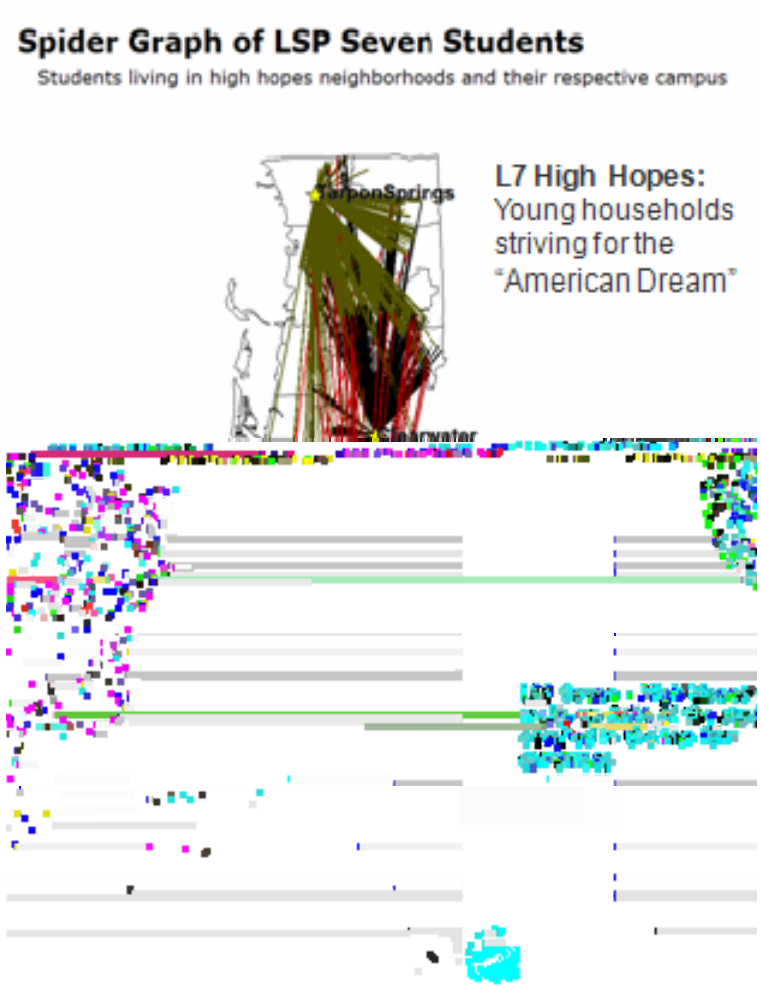


Figure 4-14. Spatial pattern of lifestyle segments five and ten for students within Pinellas County.



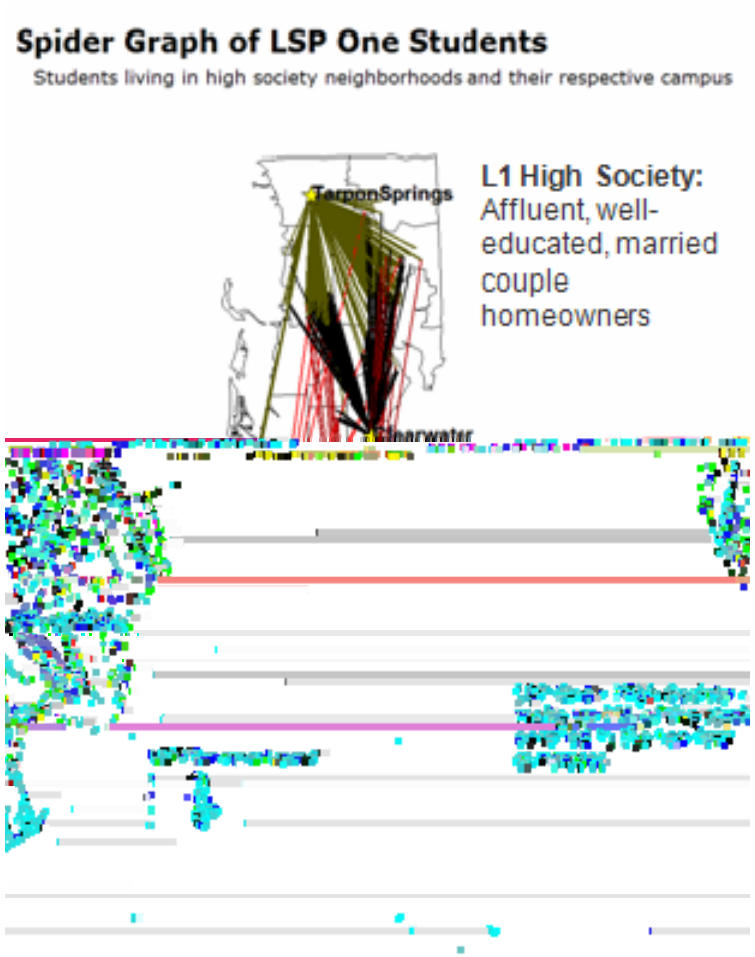


Figure 4-15. Spatial pattern of lifestyle segments one and seven for students within Pinellas County.

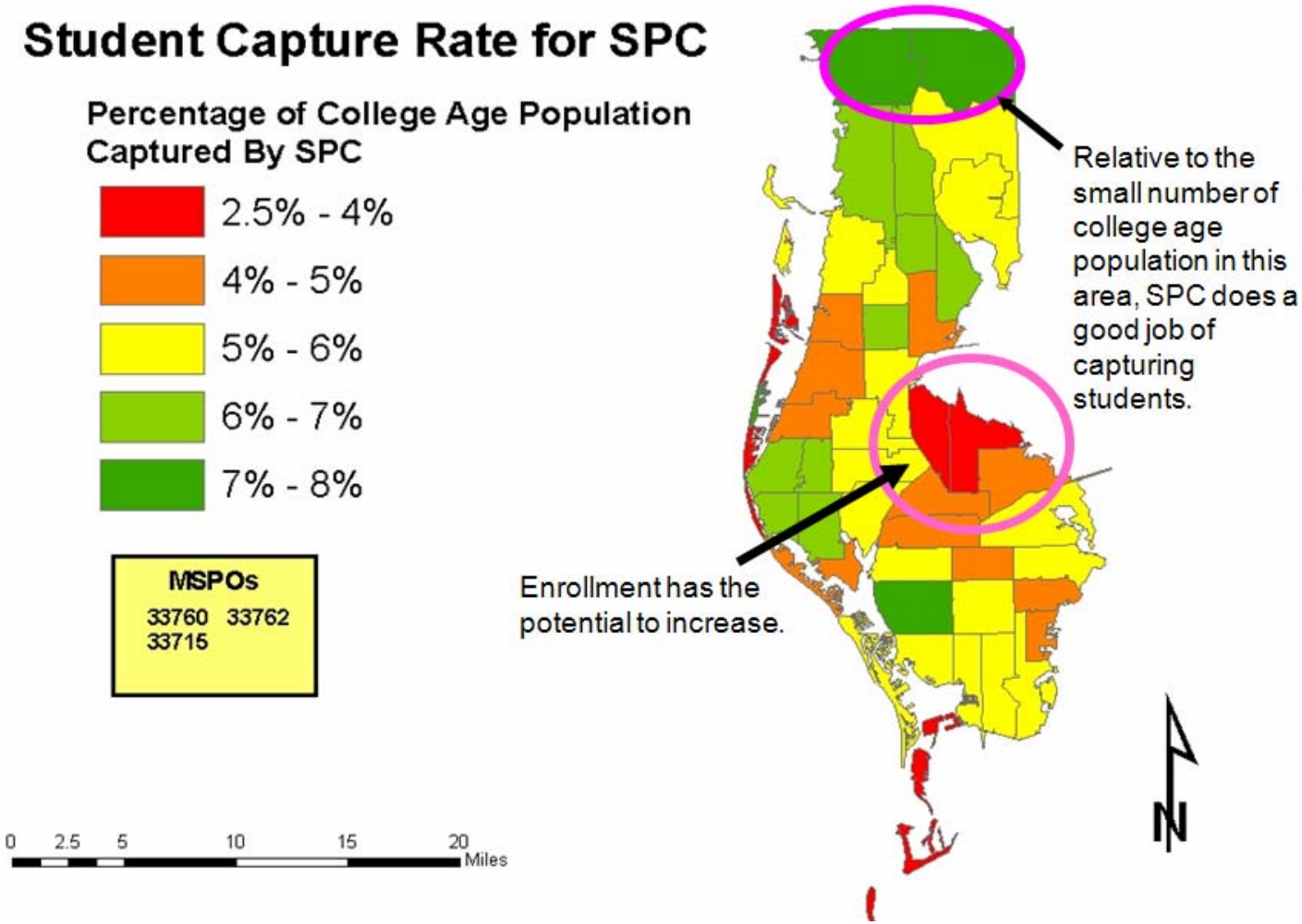


Figure 4-16. Student capture rate percentages by ZIP code.

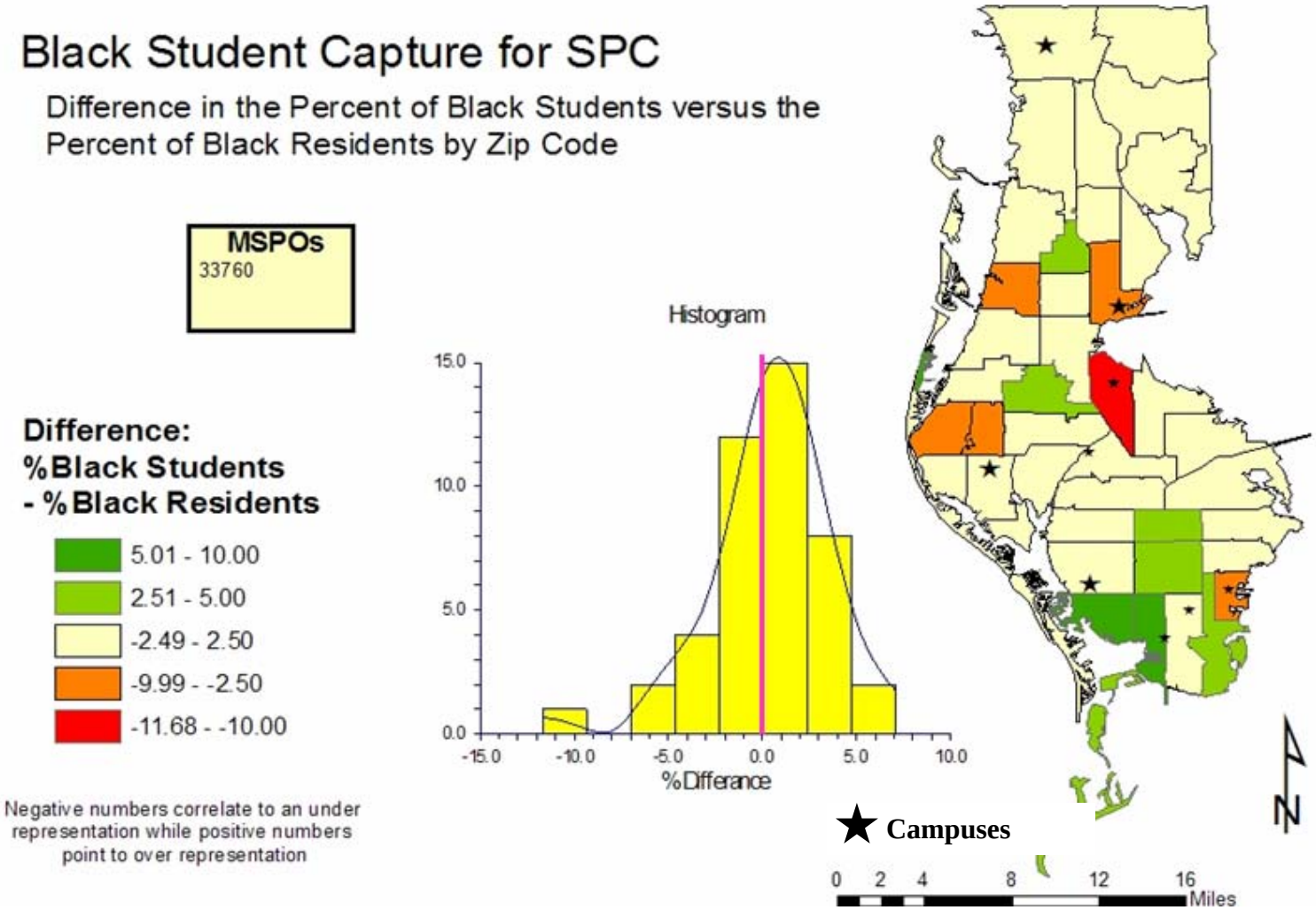


Figure 4-17. Positive and negative Black student capture rate throughout the county.

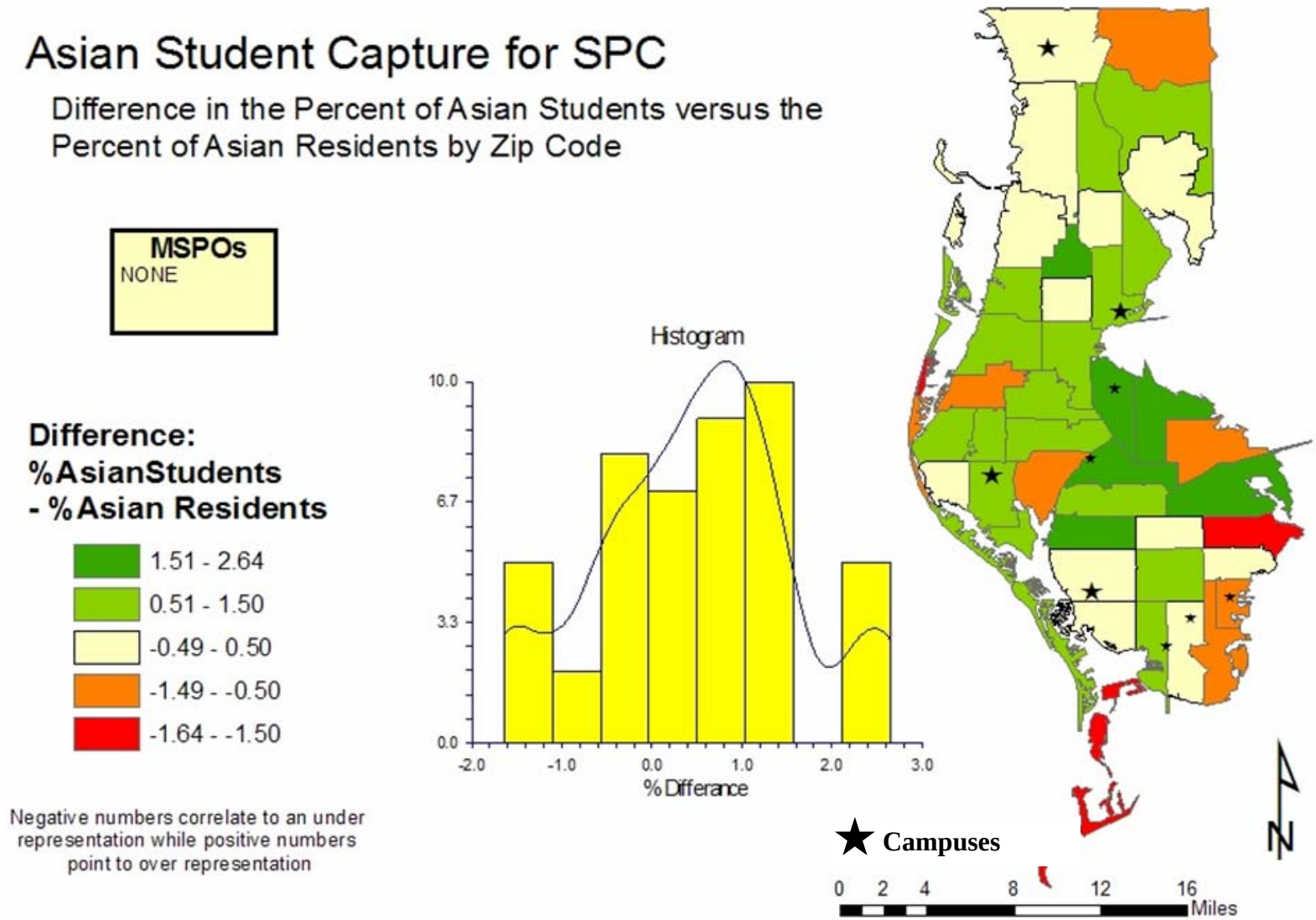


Figure 4-18. Positive and negative Asian student capture rate throughout the county.

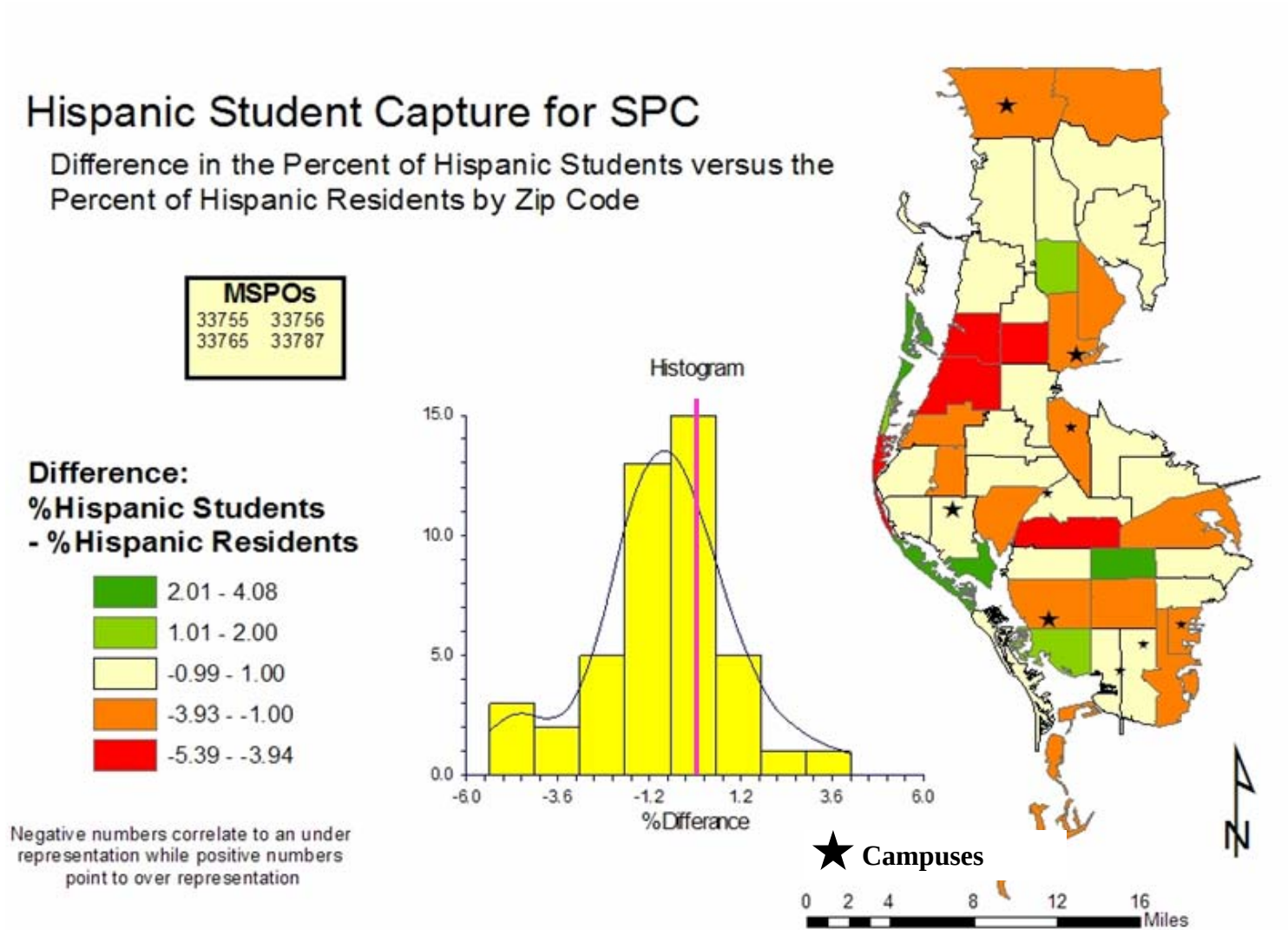


Figure 4-19. Positive and negative Hispanic student capture rate throughout the county.

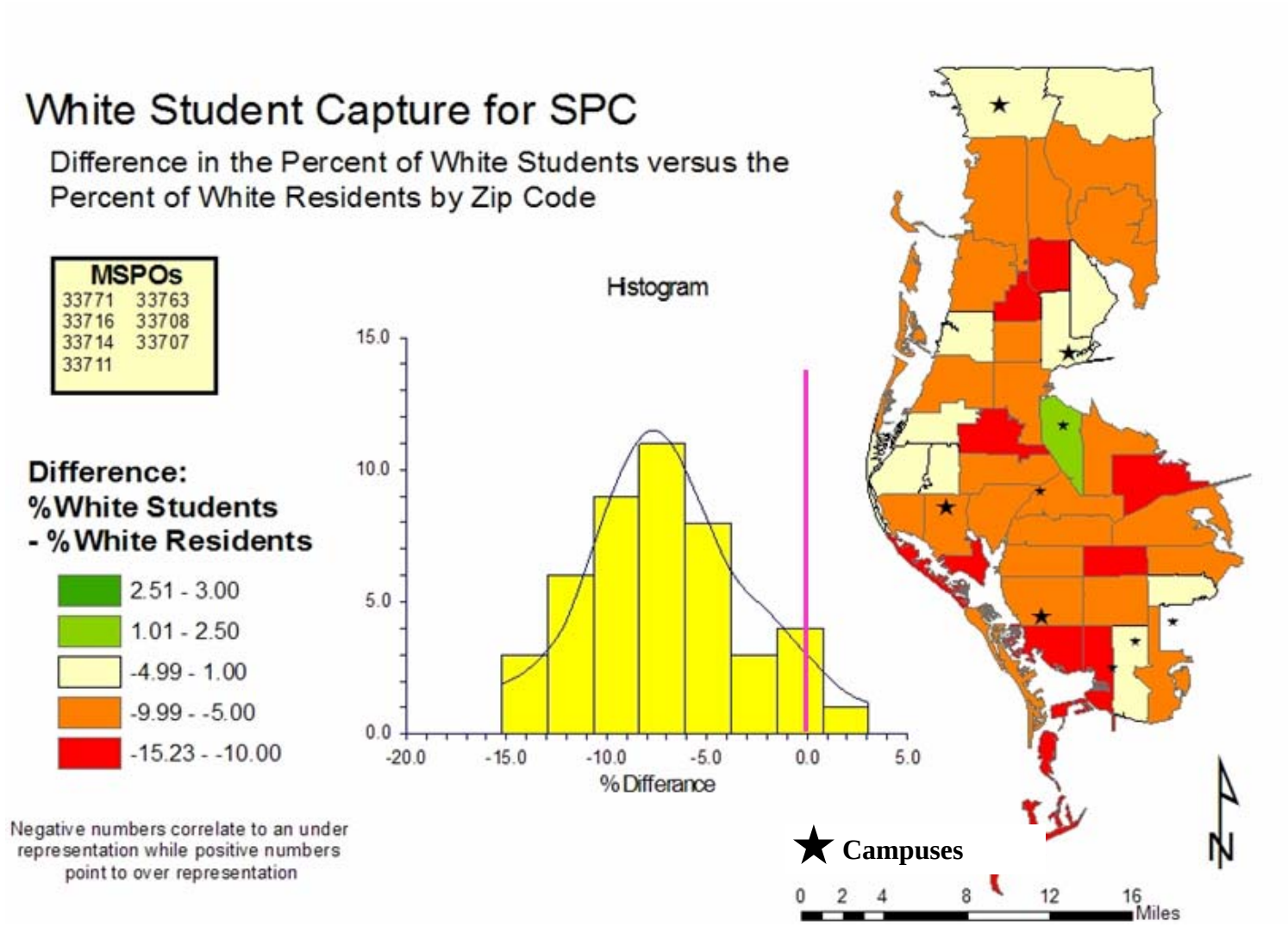


Figure 4-20. Positive and negative White student capture rate throughout the county.

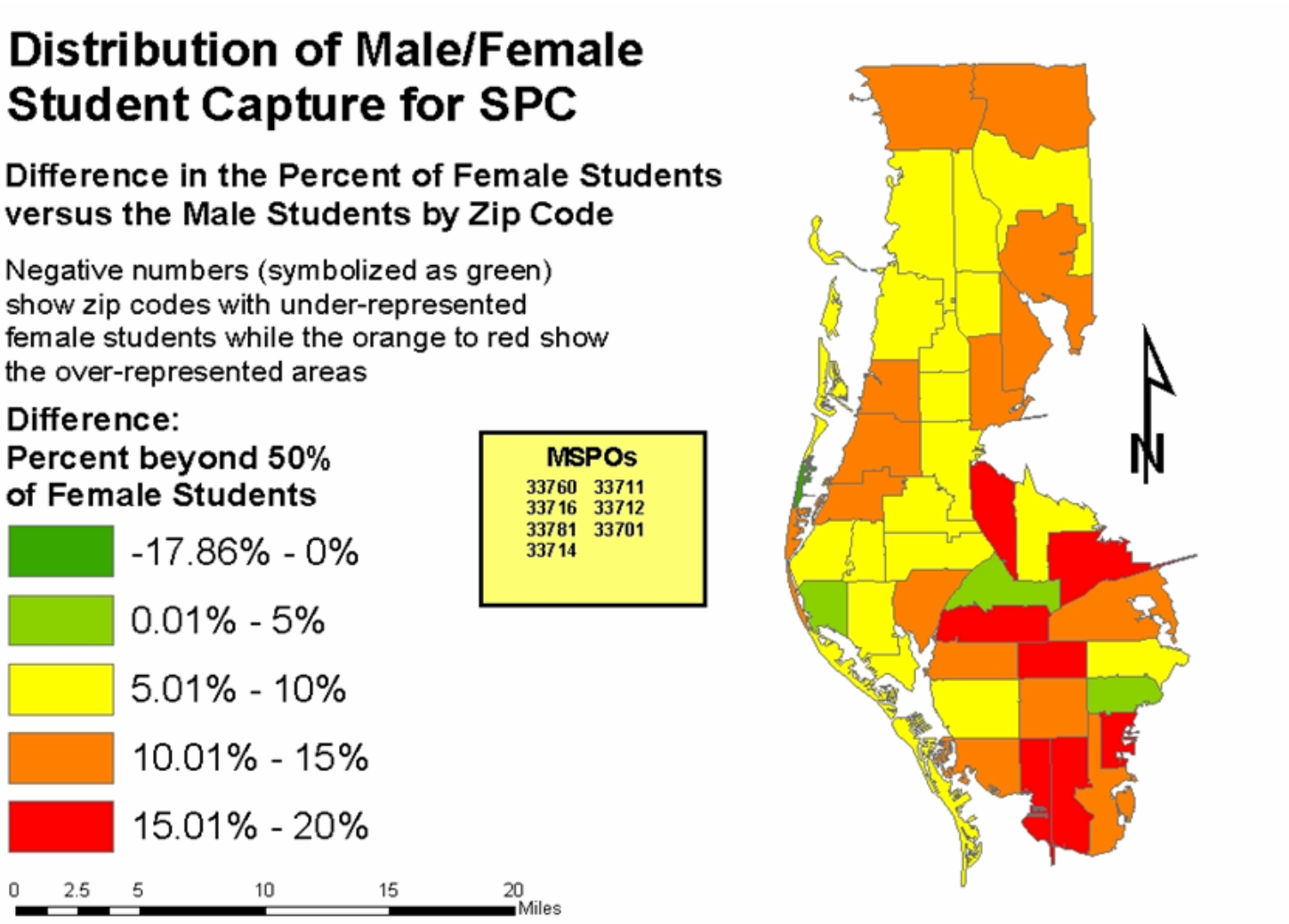


Figure 4-21. Male / Female student capture rate throughout the county.

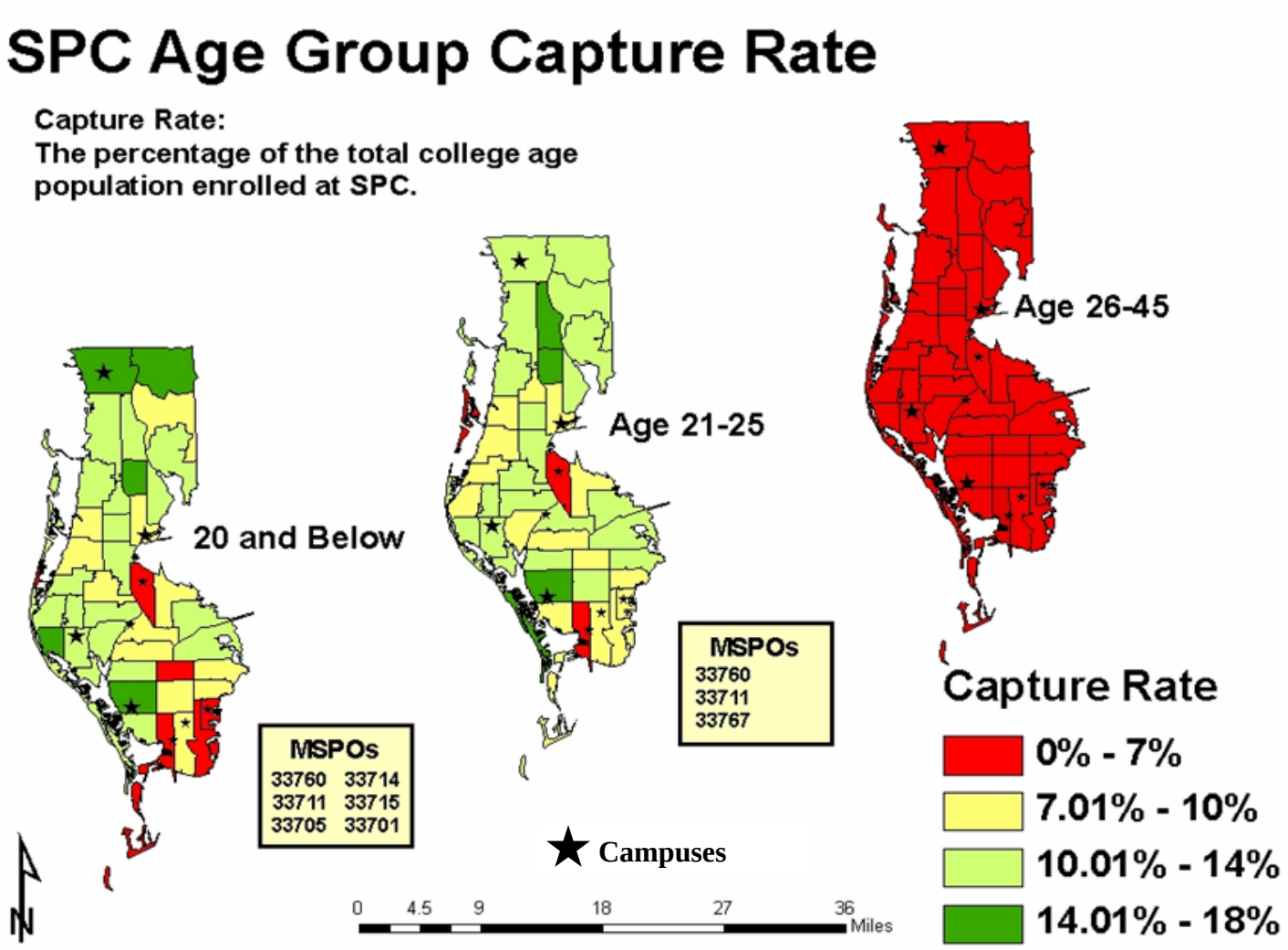


Figure 4-22. Age group capture rate throughout the county.

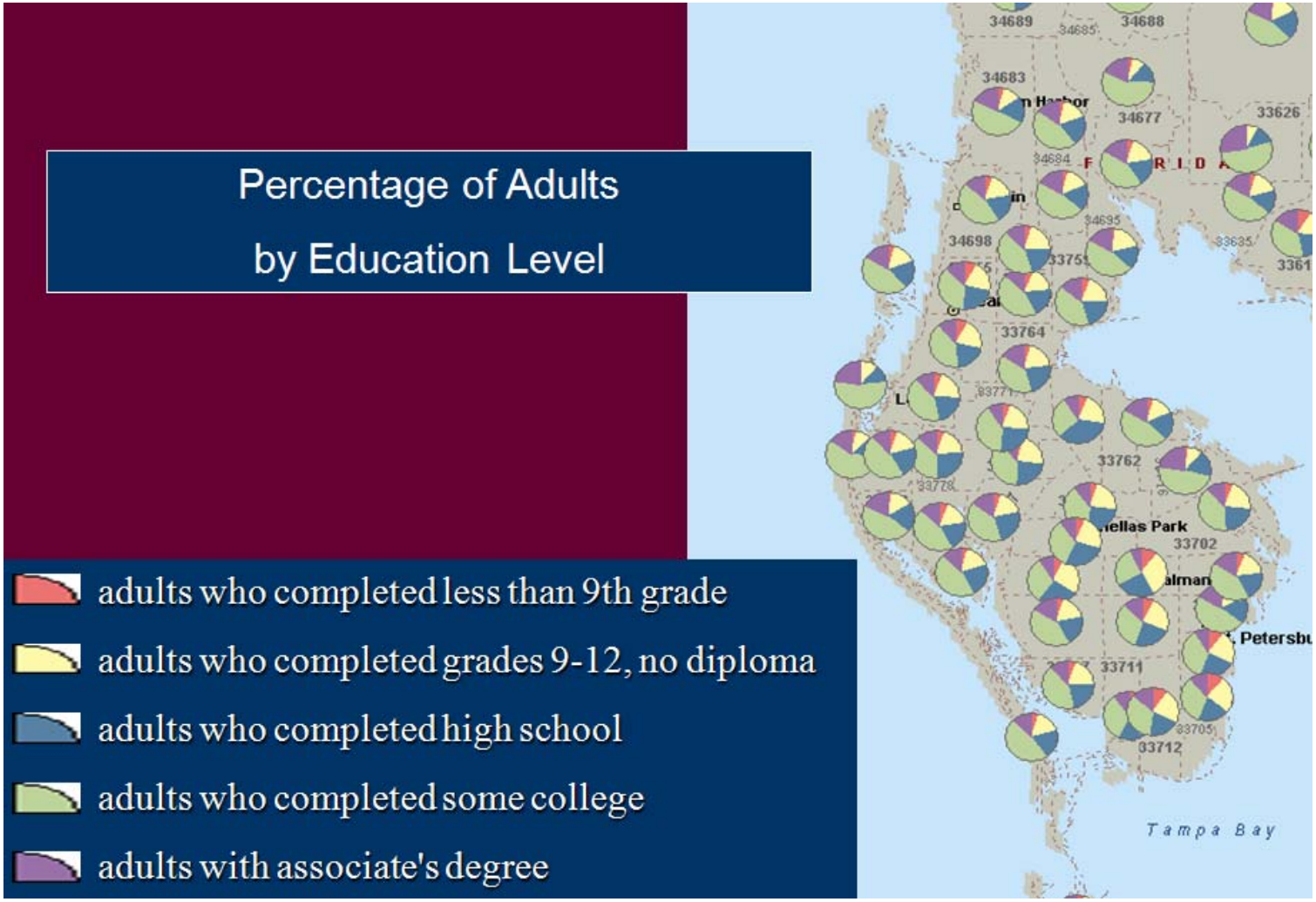


Figure 4-23. Geographic distribution of education throughout the county.

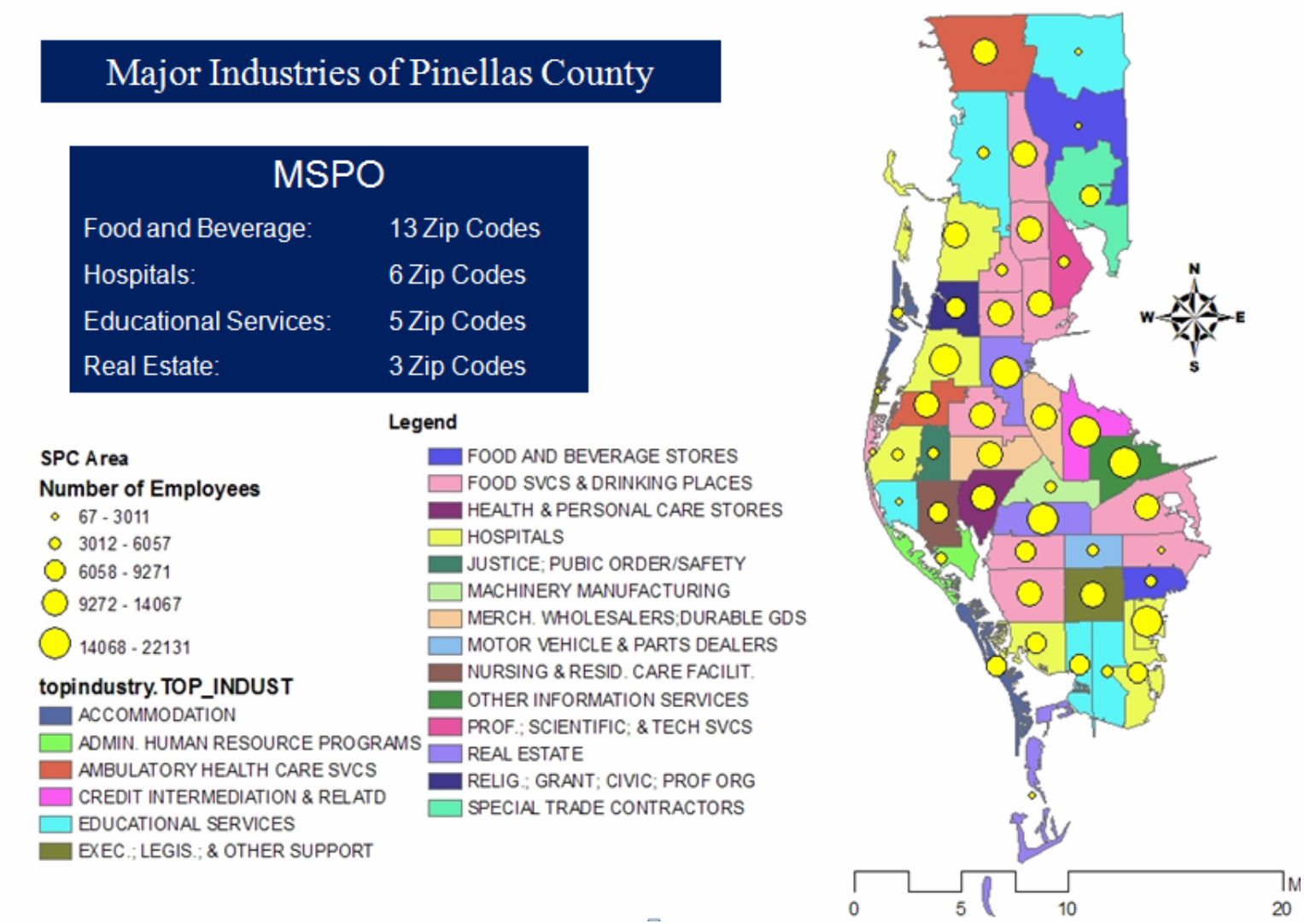
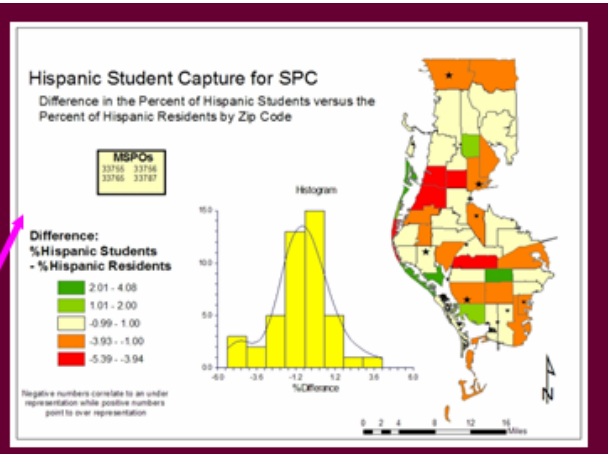


Figure 4-24. Industrial influence in the county.

Priority	Short Name	Long Description
1	Essential/Mandate/SBE Imperative	Federal, State or SACS mandate; directly supports one or more State Board of Education (SBE) Imperative(s); or contractual obligations.
2	Critical/Academic Mission/Access Expansion	Critical to College's core academic mission; direct impact on academic programs, classrooms, teaching and learning; New initiatives aimed directly or indirectly at enhanced access
3	Supportive/Student Services /Student Activities	Continues, enhances, and/or discontinues an existing support service for students and faculty; includes, for example, counseling, advising, athletic programs, etc.
4	Productivity/ Quality/Organization	Improves productivity or quality, addresses an organizational/staffing issue.
5	Desirable Objective	Desirable and beneficial objective, but may be deferred or carried forward, depending on availability of resources, without adverse impact on College operations.

2	9. Explore ways to enhance systems and services at SPC that will lead to an increase in Hispanic student enrollment. (June 30, 2006)
2	7. Launch a program to provide collegewide increased support for minority male students. (June 30, 2007)



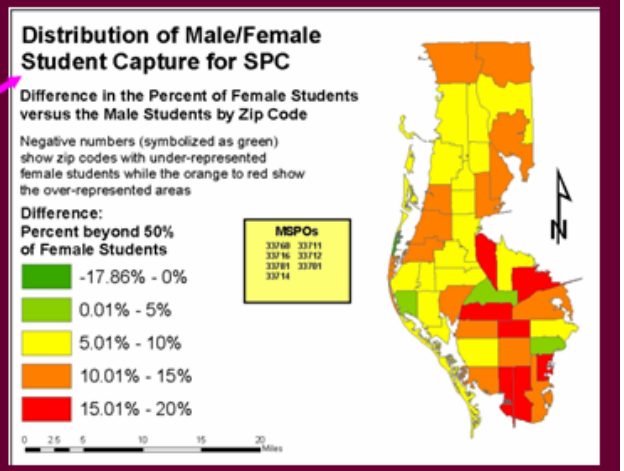


Figure 4-25. SPC objectives examined within this study.

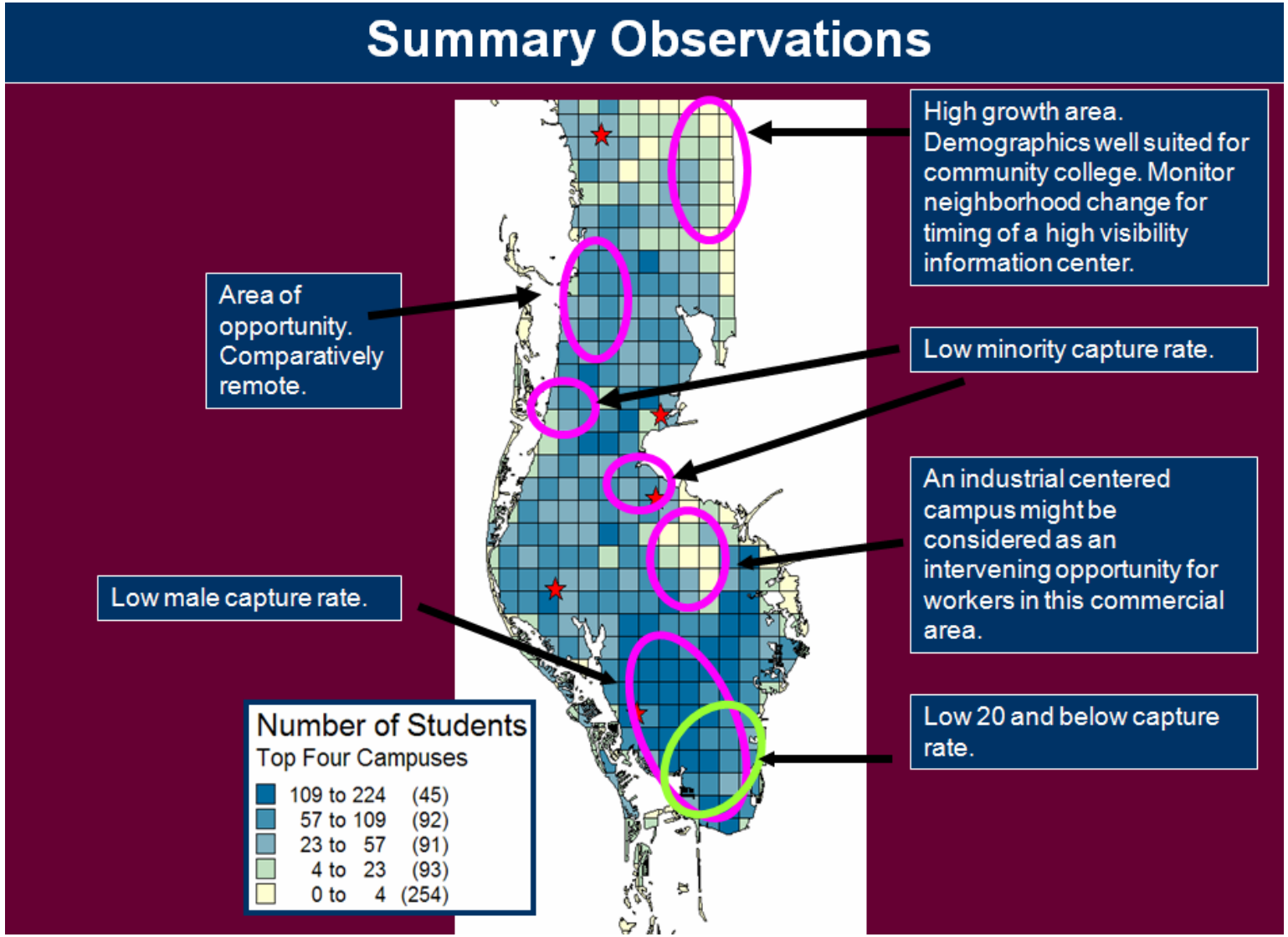


Figure 4-26. Summary observations and suggestions.

Table 4-1. Cumulative age distribution of SPC students within Pinellas County

Age	**Below 20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**51-55**	**Over 55**	**Total**
Total	5285	5128	2321	1547	1236	1026	734	443	313	18033
Percent by Age	29%	28%	13%	9%	7%	6%	4%	2%	2%	100%
Cum. % by age	29%	58%	71%	79%	86%	92%	96%	98%	100%	

Table 4-2. Fall 2005 distribution of student race by campus.

Campus	White	Black	Hispanic	Asian	Am Indian	Unknown	Total
Clearwater	5219 **77.6%**	514 **7.6%**	492 **7.3%**	247 **3.7%**	41 **0.6%**	211 **3.1%**	6724
St Petersburg/Gibbs	6674 **67.9%**	1802 **18.3%**	514 **5.2%**	394 **4.0%**	56 **0.6%**	382 **3.9%**	9822
Seminole	2324 **84.7%**	102 **3.7%**	121 **4.4%**	52 **1.9%**	15 **0.5%**	130 **4.7%**	2744
Tarpon Springs	3462 **87.1%**	103 **2.6%**	190 **4.8%**	75 **1.9%**	12 **0.3%**	132 **3.3%**	3974
Lower Division Total	**17679**	**2521**	**1317**	**768**	**124**	**855**	**23264**
UPPER DIVISION BY PROGRAM							
Dental Hygiene	84 **78.5%**	6 **5.6%**	9 **8.4%**	4 **3.7%**	0 **0.0%**	4 **3.7%**	107
Education	425 **86.4%**	41 **8.3%**	11 **2.2%**	5 **1.0%**	4 **0.8%**	6 **1.2%**	492
International Business	35 **72.9%**	4 **8.3%**	5 **10.4%**	4 **8.3%**	0 **0.0%**	0 **0.0%**	48
Nursing	174 **78.7%**	30 **13.6%**	9 **4.1%**	5 **2.3%**	1 **0.5%**	2 **0.9%**	221
Orthotics & Prosthetics	18 **78.3%**	0 **0.0%**	2 **8.7%**	3 **13.0%**	0 **0.0%**	0 **0.0%**	23
Public Safety	54 **81.8%**	6 **9.1%**	3 **4.5%**	0 **0.0%**	1 **1.5%**	2 **3.0%**	66
Technology Management	304 **77.0%**	44 **11.1%**	25 **6.3%**	15 **3.8%**	0 **0.0%**	7 **1.8%**	395
Veterinary Technology	48 **90.6%**	0 **0.0%**	1 **1.9%**	1 **1.9%**	1 **1.9%**	2 **3.8%**	53
EPI/Impact	50 **90.9%**	1 **1.8%**	2 **3.6%**	1 **1.8%**	0 **0.0%**	1 **1.8%**	55
Non-Degree Seeking	49 **90.7%**	0 **0.0%**	0 **0.0%**	1 **1.9%**	1 **1.9%**	3 **5.6%**	54
Upper Division Total	**1241**	**132**	**67**	**39**	**8**	**27**	**1514**
COLLEGE TOTAL	**18920**	**2653**	**1384**	**807**	**132**	**882**	**24778**

(SPC Factbook 2005)

Table 4-3. 2005 College wide opening fall headcount enrollment by age and by division.

	19 or less	20-24	25-29	30-39	40-49	50-59	60&over	Unknown	Total
LOWER DIVISION BY CAMPUS									
Clearwater	1430	2129	1024	1154	659	267	41	20	6724
	21.3%	**31.7%**	**15.2%**	**17.2%**	**9.8%**	**4.0%**	**0.6%**	**0.3%**	
St Petersburg/Gibbs	2018	2967	1523	1738	959	359	63	195	9822
	20.5%	**30.2%**	**15.5%**	**17.7%**	**9.8%**	**3.7%**	**0.6%**	**2.0%**	
Seminole	869	836	297	376	241	110	14	1	2744
	31.7%	**30.5%**	**10.8%**	**13.7%**	**8.8%**	**4.0%**	**0.5%**	**0.0%**	
Tarpon Springs	1199	1394	471	490	310	80	23	7	3974
	30.2%	**35.1%**	**11.9%**	**12.3%**	**7.8%**	**2.0%**	**0.6%**	**0.2%**	
Lower Division Total	**5516**	**7326**	**3315**	**3758**	**2169**	**816**	**141**	**223**	**23264**
UPPER DIVISION BY PROGRAM									
Dental Hygiene	0	6	23	36	30	12	0	0	107
	0.0%	**5.6%**	**21.5%**	**33.6%**	**28.0%**	**11.2%**	**0.0%**	**0.0%**	
Education	1	166	96	139	66	23	1	0	492
	0.2%	**33.7%**	**19.5%**	**28.3%**	**13.4%**	**4.7%**	**0.2%**	**0.0%**	
International Business	0	24	9	8	6	1	0	0	48
	0.0%	**50.0%**	**18.8%**	**16.7%**	**12.5%**	**2.1%**	**0.0%**	**0.0%**	
Nursing	0	11	31	84	71	24	0	0	221
	0.0%	**5.0%**	**14.0%**	**38.0%**	**32.1%**	**10.9%**	**0.0%**	**0.0%**	
Orthotics & Prosthetics	0	3	6	8	6	0	0	0	23
	0.0%	**13.0%**	**26.1%**	**34.8%**	**26.1%**	**0.0%**	**0.0%**	**0.0%**	
Public Safety	0	14	12	27	12	1	0	0	66
	0.0%	**21.2%**	**18.2%**	**40.9%**	**18.2%**	**1.5%**	**0.0%**	**0.0%**	
Technology Management	0	50	67	137	102	35	2	2	395
	0.0%	**12.7%**	**17.0%**	**34.7%**	**25.8%**	**8.9%**	**0.5%**	**0.5%**	
Veterinary Technology	0	6	13	18	14	2	0	0	53
	0.0%	**11.3%**	**24.5%**	**34.0%**	**26.4%**	**3.8%**	**0.0%**	**0.0%**	
EPI/Impact	0	1	6	20	23	4	1	0	55
	0.0%	**1.8%**	**10.9%**	**36.4%**	**41.8%**	**7.3%**	**1.8%**	**0.0%**	
Non-Degree Seeking	0	2	4	13	23	11	1	0	54
	0.0%	**3.7%**	**7.4%**	**24.1%**	**42.6%**	**20.4%**	**1.9%**	**0.0%**	
Upper Division Total	**1**	**283**	**267**	**490**	**353**	**113**	**5**	**2**	**1514**
COLLEGE TOTAL	**5517**	**7609**	**3582**	**4248**	**2522**	**929**	**146**	**225**	**24778**

(SPC Factbook 2005)

CHAPTER 5
IMPLICATIONS AND CONCLUSIONS

St. Petersburg College Study: After Action Review

The analysis completed for St. Petersburg College represents the overall advantages gained from a geodemographic analysis report. Geodemographic measurements are descriptive characteristics of a population, arranged and ordered by scales of geography that is meaningful to the analysis (Thrall 2002). In the SPC analysis the most meaningful geographic scale is ZIP codes because of the functional nature of postal code designation for advertising and marketing campaigns. The use of maps for geodemographic analysis provides a graphical representation of the landscape. Demonstration of the benefits of market analysis can be seen in the applications of business geography. Thrall 2002, discusses the importance of research in real estate market analysis:

> With this information in hand, an analyst then wants to predict the answers to questions such as, what will be the geography on the city in five or ten years? If a retail outlet is built here, will it be successful? In the future where will the population that is expected to be consumers or products live? Which neighborhoods will be on the decline, and which will be on the rise? Knowing the answers to such questions creates opportunity for the investor, and is the raison d'etre of the market analyst. (Thrall 2002)

This reasoning is typically used for business analysis of all sorts, but can be transformed for the use of higher education. For example, multiple branch retail outlets use this type of analysis as standard operating procedure and parallels can be drawn between multiple branch retail and multi-branch learning institutions. Both have customers with trade areas and both can benefit from market and trade area analysis. According to a recent report by the Secretary of Education for the U.S., higher education is becoming increasingly consumer market driven and students care less about whether a college is a for profit or public institution, a predominantly online or brick and mortar instructional system, and more about absolute results (Spellings 2006). This evolution of students into consumers of education along with the need for

innovative methods of reaching the disadvantaged segments of the population give validation to the methods described in the SPC study. Based on the findings, SPC will have a better understanding of the demographic characteristics of the county and a better understanding of which markets and submarkets to target in order to meet the institutional objectives and goals.

Typically an after action review, a term borrowed from the US Army that describes a post training exercise review, is designed to 1) investigate and discuss expected outcomes, 2) examine unexpected outcomes , and 3) determine what could have been done to improve the sequence or lend strength or relevance to the action in question. The first and third components of this review are useful for this study, however unexpected outcomes will not be discussed.

Expected Outcomes

The SPC study started as a project designed to investigate declining enrollment of students at the college. A primary intention of the project was to give the college a better understanding of the student population based on the physical location of the students and the characteristics and relationships that can be determined based on location. Using Geospatial technology the students of SPC were assigned geographic coordinates and plotted on map that contained ZIP codes and demographic data for the people within these ZIP codes. With the knowledge of how many students are living within these ZIP codes in Pinellas County, analytical relationships were asserted and recommendations about marketing and recruitment were made to the college.

Along with ZIP code boundaries the analysis also used ZIP + 4 boundaries and with the use of methods and tools of business geography lifestyle segmentation profiles (LSP) were assigned to all the students. This allowed for analysis of the student population based on lifestyle profiles. ZIP codes were then labeled based on the majority or dominant lifestyle population. Specific recommendations were not given to the college based on the geographic distribution of student lifestyles, but a more general landscape view is presented in the form of a

map with ZIP codes shown for Pinellas County with designated LSPs as well as LifeMode groups. The maps presented to SPC provide administrators with a descriptive as well as predictive view of the community's population demographics and the student's demographic consistency.

Another intended outcome of the project is the designation of segments of the population that can be greater served by the college. The market segments of potential opportunity (MSPO) are segments used to show potential areas of improvement throughout the stages of analysis. The MSPOs listed with the various maps and are primarily applied to ZIP codes and designate segments of the population based on the criteria used to produce the map.

Limitations and Possible Improvements

The SPC study revealed a few notable points for improvement or change when this type of study is conducted in the future. For example, the study was broad in nature and from the beginning of the study there were few specific questions identified to answer using geographic technology. The Vice President of Economic Development for the SPC was general in requests for the study to decrease the rate of decline in enrollment. Narrowing the scope of the analysis to more specific issues was accomplished by viewing the one and three year objectives published by the college. The initial objectives could have been more structured to establish detailed criteria for investigation rather than using objectives delineated by the college. A general geodemographic analysis of the landscape provided an appropriate starting point. Future research that incorporates education planning and GIS should aim to identify key questions and concerns that can be used to drive further analyses of preliminary results.

Another consideration to further the validity of the such research is the appropriateness of the demographic classifications for the education institute in question. The zip codes, though useful for SPC postal marketing, were a course scale dataset that did not allow for detail with

regards to local populations. Use of census blocks as the core geographic unit of analysis would increase the resolution of data and thus increase the detail and accuracy of findings. However, considering the marketing value of using ZIP codes, a combination of ZIP codes, ZIP +4 codes, and census blocks would provide the most useful data for both analysis and marketing purposes.

Finally, the student population included in the analysis only accounted for students living within Pinellas County because SPC marketing is limited to within the county borders. Limitations to the extent of marketing is the result of state rules used to maximize the resource allocation to community colleges by discouraging competition between state funded higher education institutions. This means that although analysis looks at a large portion of the student body, in fact the analysis relies on a sample of the study body and could be expanded (though not for marketing purposes) to include students traveling from outside of Pinellas County.

Implications for Higher Education Planning

Despite limitations, my research demonstrates that the geographic landscape is very important consideration for higher education for a variety of reasons. As discussed in chapter two GIS can be used as proficient determinant of socioeconomic status (SES) (Pennington 2002). Maps can then be generated to display the SES of distribution of students throughout the trade area of the college or even the state. Once student SES is mapped various components of the landscape such as demographic characteristics, industry influences, environmental characteristics, and even lifestyle segmentations can be overlayed to examine geographic relationships (Pennington 2002).

As described by Bailey 2006, SES is used for determination of financial aid distribution and for many students SES is unknown. Determining SES through the use of GIS can improve reporting for tuition and financial aid policy. Tracking the changes in the landscape of student SES or LSP over time is also a valuable use of GIS for higher education. Looking back at 1990

or 2000 census data to visualize the changes in demographics and student locations over time gives state or institutional planners better information for forecasting and future planning (Pennington 2002).

Using GIS for management of programs is also advantageous for institutional researchers and college planners. Identification of market segments and particular neighborhoods for college expansion or reduction can result from the use of GIS for institutional planning. A better understanding of service areas gives institutional researchers more intuitive capabilities of providing services. For example, resources can be allocated for courses such as English as a second language (ESL) to campuses near neighborhoods dominated by non-English speaking families (Pennington 2002). Although infrequently used geospatial analysis and GIS serve to maximize decision making in higher education institutions.

The adoption of geographic technology and methodologies to the business realm resulted in the formation of business geography. Business geography is a sub discipline that focuses on identifying the needs of business and tailoring business to the client. Based on commonalties with the business world, including the need to provide services to a client and base decisions on trade area needs, higher education can benefit from utilizing geographic technologies and analyses. Understanding geographic characteristics can assist in evaluating institutional objectives, and identify constraints on implementing these objectives. Geography is an integral component of decision making in business today, and should be incorporated in the decision making of public institutions, including education.

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BIOGRAPHICAL SKETCH

Phillip Allen Morris was born and raised in southwest Virginia. He graduated from Auburn High School in 1997 and immediately enlisted in the U.S. Army. After serving a two and a half year enlistment he was honorably discharged and began undergraduate study at Concord University in Athens, WV. While studying at Concord, Phillip was a member of the West Virginia Army National Guard and a member of the university basketball team.

Upon graduation from Concord in 2003 Phillip deployed with his National Guard unit as part of Operation Iraqi Freedom II. Phillip finished his enlistment with the National Guard in 2005, prior to enrollment in the Department of Geography at the University of Florida. Upon graduating with his MA from the University of Florida, Phillip will pursue a Ph.D. degree from the department of Education Administration and Policy.