LEADING STRATEGIES

Using the Esri System to Enhance Campus Strategic Enrollment Marketing Efforts

By Andrew Luna and Michael Wilson

In an attempt to utilize Geographic Information (GIS) Center technology as part of the institution's overall enrollment management endeavors, the department of Decision Support and Institutional Research at Austin Peay State University reached out to the institution's GIS Center to determine how the ESRI system technology could be used to pinpoint concentrated markets, trends in market growth and decline, identification of new markets, and how the two offices could provide unique marketing data for the institution. The mission of the GIS Center is to provide small businesses and government entities access to geographic mapping and spatial data analysis. This article outlines the results, conclusions, and recommendations of the project.

The field of Geographic Information Systems (GIS) started in the 1960s as computers and computational geography emerged. Michael Goodchild, a British-American geographer, formalized GIS research to include key geographic information science topics such as spatial analysis and visualizations (Esri 2018).

The first computerized GIS system was developed by Roger Tomlinson to allow the Canadian government to create a manageable inventory of its natural resources and Tomlinson's vision enabled the government to establish its national land-use management program. At this point, GIS systems were seen in limited terms of land inventory and management. Later, a Harvard Lab employee, Jack Dangermond and his wife founded Environmental Systems Research Institute, Inc. (Esri 2018).

The firm applied computer mapping and spatial analysis to help land-use planners and resource managers make better informed decisions. In 1981, the company went public, and many business and educational institutions were using the mapping software product.

Esri is now considered the premier GIS software maker. According to Esri (2018),

> "*A geographic information system (GIS) is a framework for gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations—helping users make smarter decisions*" (3).

From a technical standpoint, a GIS is a type of management information system. The system is designed to work with data that is spatially referenced. Simply put, GIS is a spatially-aware database with specific capabilities for manipulating data with a geographic component, as well as a set of operations for analyzing the data (Chrisman 1999).

While Esri released the first commercially available GIS system for mainframe computers in 1982, it was not until the 1990s that GIS gained traction outside of large governmental agencies. In the 1990s, as computing power increased and hardware prices plummeted, GIS became a viable technology for state and local government (Brovelli 2006). The growth of GIS has continued to the present. Some common uses of GIS include (Millsaps 2018) mapping for:

- Planning and zoning
- Property assessment
- 911 Response
- Disaster relief
- Route planning
- Crime analysis
- Health

The literature is rich regarding the use of GIS software in the higher education classroom. For example, Jo and Hong (2020) and Perugini and Bodzin (2020) maintain that GIS systems help enhance students' ability to generate and recognize spatial concepts. Furthermore, Jant *et.al* (2020) found that GIS systems more broadly enhance students' science, technology, engineering, and math (STEM) reasoning skills.

While there exists a lot of information on how GIS systems are used in the classroom, information on it being used outside the classroom and for higher education administrative purposes is sparser. Ousley (2010) maintains that GIS systems can be useful in developing characteristics for predicting student persistence and graduation, while Yuan (2020) suggests that school districts, college recruitment offices, and other centers or departments within a college and university can attain straightforward images of the geographical distribution of their students. Therefore, the use of a GIS system can complement enrollment management efforts. According to Muhammad and McManus (2018), it is important that an institution's strategic enrollment management data be robust so that it is not inaccurate, leading to poor decision-making. However, Johnson (2016), suggests that while it may not be difficult to find data for enrollment management purposes, finding data that are correct and timely is more difficult. With Esri, the data are regularly updated, and the data sources are usually government agencies and other viable data producers.

Morris and Thrall (2010) found that, among the valuable information that higher education institutions can create using GIS technology are psychographic profiles of student populations, commuting patterns, the underlying demographics of the institution's target area, and the ability to plan for new facilities to meet the need of the market. Mora (2003) outlines how a major public research university was utilizing GIS technology to help with strategic and tactical decision in student recruitment on its main campus. It should be noted that GIS technology can quickly identify particular demographic areas that support the strategic use of social media. According to Reyes (2023), social media marketing strategies are vital to institutions and are a key component of influence and attitudes during the decision-making process. Furthermore, it is important to capture data that will help strategic enrollment managers pinpoint areas where the institution should focus.

GIS at APSU

The Austin Peay State University GIS Center has served the Clarksville, Tennessee community for 20 years.

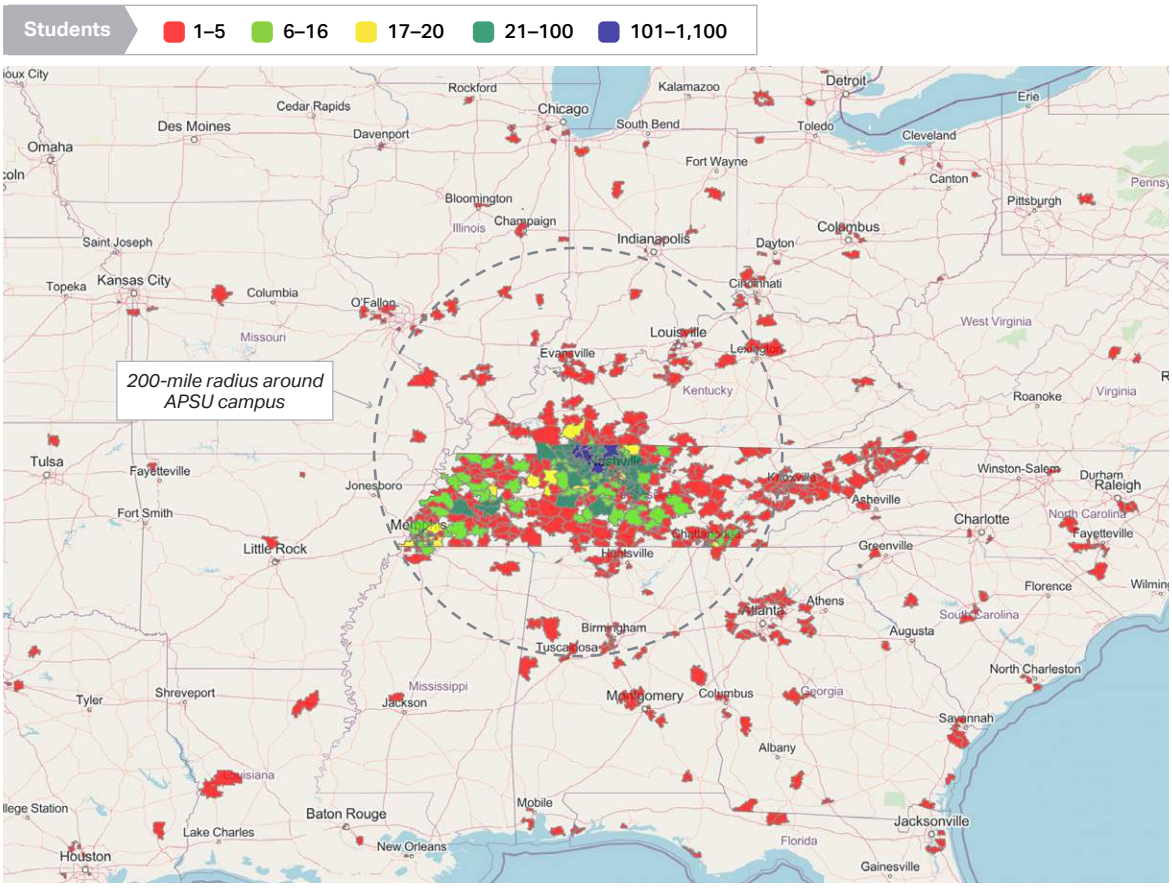

FIGURE 1 ➤ Permanent Residence of APSU Freshmen 2018–2022, by Student Count within Zip Code Boundaries

Over the years, the center has worked on a variety of GIS, GPS, and technology projects. The center uses its experience to bring value to clients by showing them that solutions to questions do not have to be expensive and complicated. They are able to utilize the software to find simple solutions that maximize limited client resources. APSU GIS researchers, professionals, and student workers collaborate to deliver their experience and service to numerous constituencies.

The university and the APSU GIS Center have leveraged an Esri Campus site license. These licenses are utilized for research efforts at the GIS Center, Center of Excellence of Field Biology, Southern Grassland Initiative, and other research projects. The licenses are also used by various academic classes. The site licenses give APSU access to numerous pieces of GIS software. These include ArcMap, ArcGIS Pro, and ArcGIS Online.

In an attempt to utilize this GIS technology as part of the institution's overall enrollment management endeavors, Decision Support and Institutional Research reached out to the GIS Center to determine how the technology could be used to pinpoint concentrated markets, trends in market growth and decline, identification of new markets, and how the two offices could move the project forward.

The map located in Figure 1 depicts where APSU's freshman cohorts of 2018 to 2022 permanently reside. It is clear that the majority of these students mainly come from the Clarksville, Tennessee area as well as other places around middle Tennessee. The red circle in the map denotes a 200-mile radius from Clarksville,

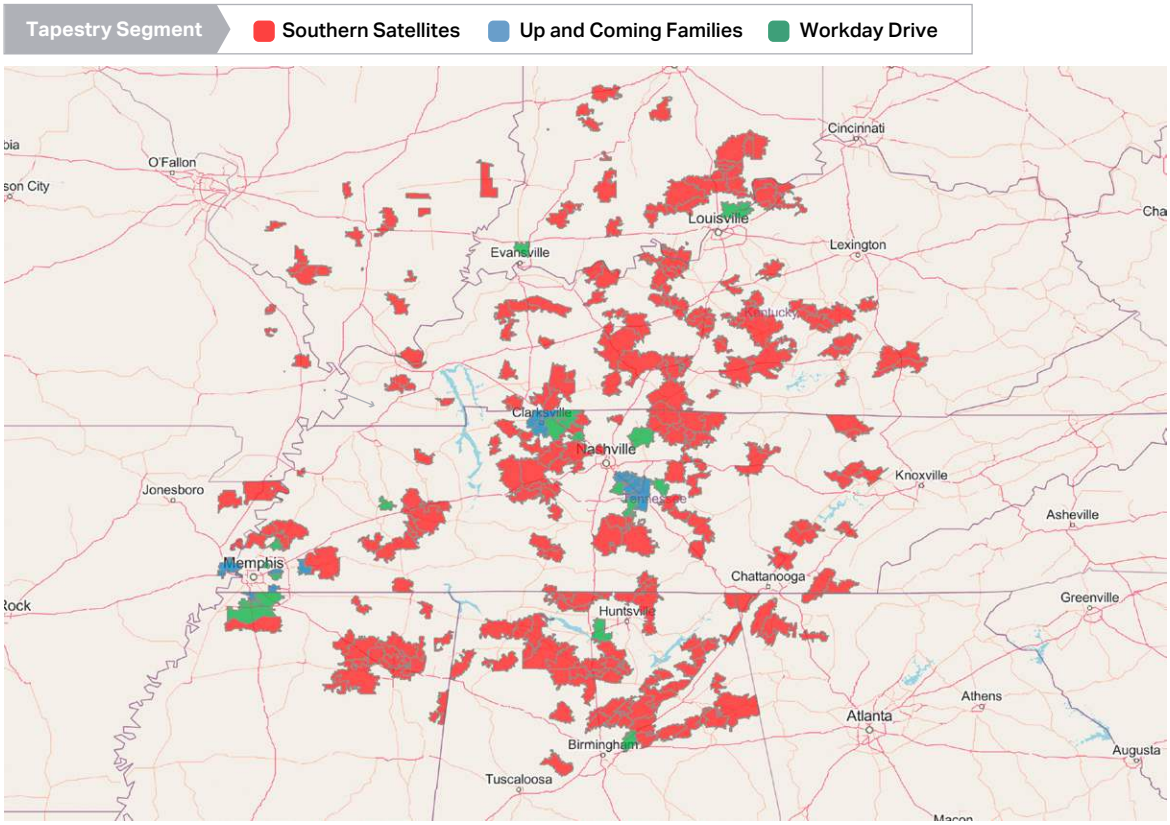

FIGURE 2 ➤ Main Tapestries of APSU Freshmen 2018–2022, by Tapestry Segment within Zip Code Boundaries

indicating the potential market reach of APSU and the enrollment management team. Rather than trying to address this entire area, it would be optimal to target specific segments based upon various demographic and sociographic data similar to APSU's freshman class.

Methodology

To explore the possibilities of utilizing GIS technology with enrollment management, DSIR sent a data file containing the information on the freshman cohorts for the Fall 2018 to Fall 2022 semesters and included their permanent address. In the original 2021 report, DSIR and the GIS Center used zip codes rather than the more narrowing defined permanent address. These permanent addresses were fed into the Esri system and a comprehensive map was constructed whereby various sociographic data could be plotted. These datasets included population, demographic, crime, and educational attainment statistics. One of the more interesting Esri datasets is the Tapestry Segmentation. As described by Esri:

> "*Tapestry Segmentation classifies neighborhoods into 67 unique segments based not only on demographics but also socioeconomic characteristics. It describes US neighborhoods in easy-to-visualize terms, ranging from Affluent Neighborhoods to Heartland Communities*" (6).

Simply stated, the Tapestry data represents a large collection of demographic, purchasing, and economic data that can be combined geographically with other datasets to give the user a rich understanding of an area's socioeconomic status. For example, when combined with enrollment data, Esri ArcGis Online (AGOL) and Tapestry can give an indication of the types of socioeconomic areas that draw APSU students.

Plotting the freshman cohorts, the map quickly displayed a color-coded representation of the various Tapestry Segments across the county of where APSU's new freshmen permanently resided. A screen capture in Figure 2 indicates examples of these Tapestry Segments within portions of the middle Tennessee/southern Kentucky area. Because there are often multiple Tapestry Segments within a particular zip code, utilizing students' permanent address allowed the new study to pinpoint the specific Tapestry Segment corresponding to that student rather than collecting the most prominent Tapestry Segment within that zip code.

Seeing that this dataset could be useful in enrollment management research, DSIR requested the GIS Center to retrieve the Tapestry Segments of zip codes within a 200-mile radius of the APSU campus. These data were downloaded onto a spreadsheet for further analysis.

Clearly running analysis on 67 unique Tapestry Segments would render an over-abundance of information because only a few segments would contain a majority of the students; others would have only a few; and many more would have no students at all. As a way to effectively manage these segments into smaller groups, Esri created fourteen broader LifeMode groups. Table 1 (on page 36) displays all of the Tapestry Segments within their respective LifeMode groups. While the analysis run by DSIR includes both the Tapestry Segment and LifeMode groups, the majority of that analysis described in this paper will focus on the LifeMode groups.

Since publishing the original study, Esri changed some of the names of their LifeModes and Tapestry Segments. Specifically, the LifeMode "Ethnic Enclaves" was changed to "Sprouting Explorers." Furthermore, within Tapestry Segments, "Soccer Moms" was replaced with "Workday Drive;" "American Dreamers" was change to "Urban Edge Families;" "Barrios Urbanos" was changed to "Forging Opportunity;" "Valley Growers" was changed to "Farm to Table;" "Hardscrabble Road "was changed to "Hometown Heritage;" "Diners and Miners "was changed to "Economic BedRock;" "International Marketplace" was changed to "Diverse Convergence;" and "Las Casas" was changed to "Family Extensions."

Process

Five years of APSU freshman cohort data from 2018 to 2022 were matched by permanent address to the GIS-generated database containing the Tapestry Segments. Each segment was then placed into one of the fourteen LifeMode groups for analysis. The specific goals for the project were to determine concentrated markets, trends in market growth and decline, and identification of new markets. By observing five years of freshman cohort data, the researchers believed these goals could be accomplished.

Once the top three LifeModes containing the majority of APSU freshman cohort students were established, the researchers then identified those Tapestry Segments within the LifeModes that contained the majority of students. At this point, the researchers could then isolate all of the zip codes within a 200- mile radius of APSU as possible areas to direct marketing campaigns. Because all Tapestry Segments differ from each other in both demographic and sociographic characteristics, individual marketing plans could be developed for each of the top Tapestry Segments.

To calculate distance of APSU to any location using zip codes, the longitude and latitude coordinates were added to the data file for each zip code. Next, each longitude and latitude value was converted to radians, and the Great Circle Distance Formula was used to calculate distances in miles between the two pairs of values.

As can be seen in Figure 3 (on page 37), while there has been an increase in the percentage of new freshmen whose permanent residence is less than 50 miles over the past five years, a slight decrease can be seen in those freshmen who permanently reside 50 to 99 miles away, and also with those freshmen whose permanent address is 100 to 199 miles away. There is little change with the percentage of students attending APSU who permanently reside 200 miles or more away.

Limitations of the Study

As with all analyses, limitations exist that have some level of statistical and/or scientific impact to the results. Within this study, two limitations should be noted:

TABLE 1 ➤ LifeModes with Included Tapestry Segments

LifeMode	Tapestry Segment	LifeMode	Tapestry Segment
Affluent Estates	▸ Top Tier ▸ Professional Pride ▸ Boomburbs ▸ Savvy Suburbanities ▸ Exurbanites	**Next Wave**	▸ Diverse Convergence ▸ Family Extensions ▸ NeWest Residents ▸ Fresh Ambitions ▸ High Rise Renters
Cozy Country Living	▸ Green Acres ▸ Salt of the Earth ▸ The Great Outdoors ▸ Prairie Living ▸ Rural Resort Dwelling ▸ Heartland Communities	**Rustic Outpost**	▸ Southern Satellites ▸ Rooted Rural ▸ Economic BedRock ▸ Down the Road ▸ Rural Bypasses
Family Landscapes	▸ Workday Drive ▸ Home Improvement ▸ Middleburg	**Senior Styles**	▸ Silver and Gold ▸ Golden Years ▸ The Elders ▸ Senior Escapes ▸ Retirement Communities ▸ Social Security Set
GenX Urban	▸ Comfortable Empty Nesters ▸ In Style ▸ Parks and Rec ▸ Rustbelt Traditions ▸ Midlife Constants	**Scholars and Patriots**	▸ Military Proximity ▸ College Towns ▸ Dorms to Diplomas
Hometown	▸ Family Foundations Traditional Living ▸ Small Town Simplicity Modest Income Homes	**Sporting Explorers**	▸ Up and Coming Families ▸ Urban Villages ▸ Urban Edge Families ▸ Forging Opportunity ▸ Farm to Table ▸ Southwestern Families
Middle Ground	▸ City Lights ▸ Emerald City ▸ Bright Young Professionals ▸ Downtown Melting Pot ▸ Front Porches ▸ Old and Newcomers ▸ Hometown Heritage	**Upscale Avenues**	▸ Urban Chic ▸ Pleasantville ▸ Pacific Heights ▸ Enterprising Professionals
Midtown Singles	▸ City Strivers ▸ Young and Restless ▸ Metro Fusion ▸ Set to Impress ▸ City Commons	**Uptown Individuals**	▸ Laptops and Lattes ▸ Metro Renters ▸ Trendsetters

Zip Codes—when the study was first designed, it was determined that the zip code where the student permanently resides would be used. Many zip codes cover a broad area. Conversely, the Tapestry Segments used within the Esri mapping system is more finitely defined. Subsequently, there can be many Tapestry Segments contained within one zip code. To control for this issue, Esri has the ability

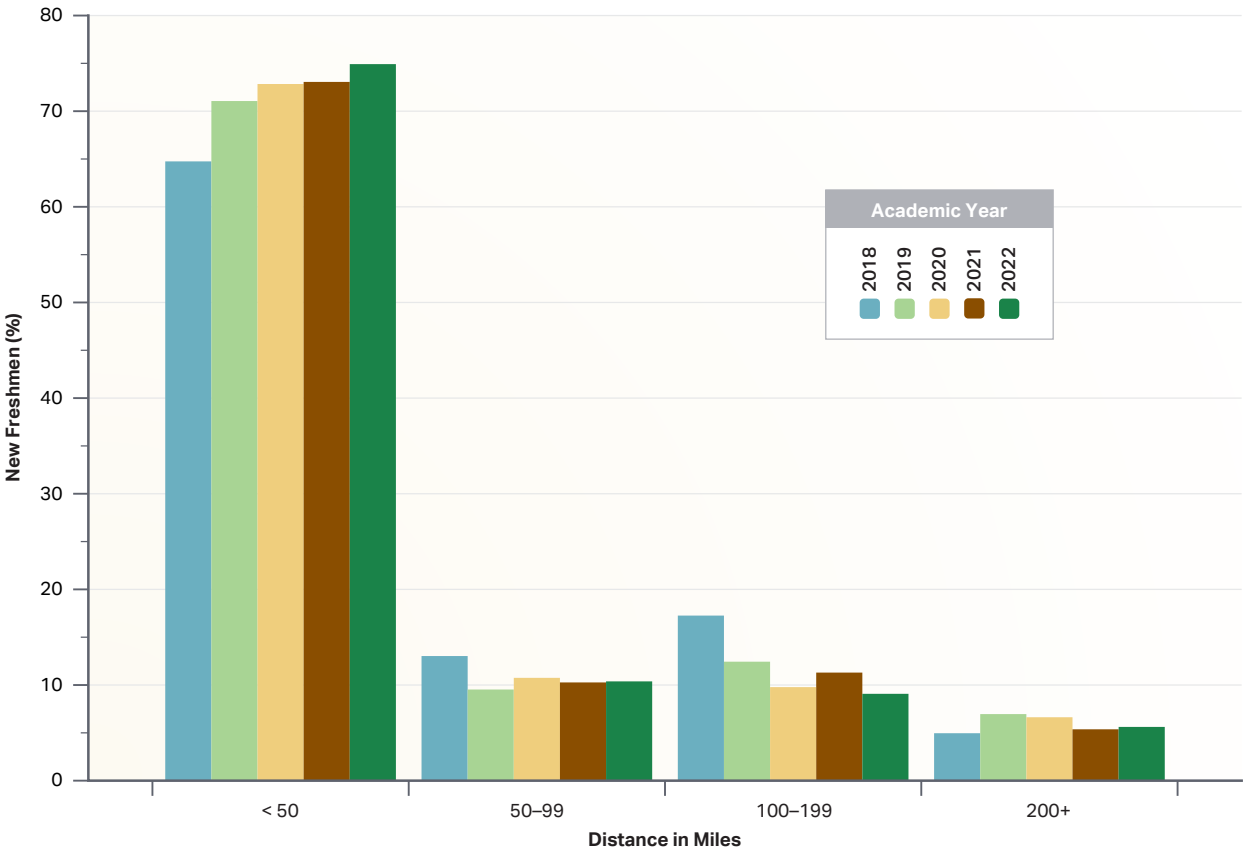

FIGURE 3 ➤ Distance From Home to APSU, by Academic Year (2018–2022)

to determine the most dominant Tapestry Segment within a particular zip code. In the current study, the student's physical address was used instead of zip codes and, therefore, identifies the actual Tapestry Segment where that student permanently resides.

Timeframe—This study used data from the last five freshman cohorts to cover the years 2018 to 2022. However, the Esri system is based upon current-year data. During the five-year time span, an area could change from one Tapestry Segment to another. Therefore, the Tapestry Segment that is identified for the freshman cohort of 2018 is actually the dominant Tapestry Segment assigned to that permanent address during the year 2022. While this issue probably has minimum impact on the study, the results would be different if the Esri system were able to identify historical Tapestry Segments.

Results

A total of five APSU freshman cohorts from 2018 to 2022 were compared to the permanent address data through the Esri system. Data from the mapping system were then pulled down and added to the freshman cohort dataset. One of the data elements that was pulled from the GIS system was the Tapestry Segmentation which is a geodemographic segmentation system that integrates consumer traits with residential characteristics to identify markets and classify U.S. neighborhoods. Within the Tapestry Segments are fourteen broader LifeMode groups, which represent markets that share a common experience (*i.e.* born in the same generation or immigration from another country) or a significant demographic trait, like affluence. The majority of the analysis within this paper will center around the LifeMode groups—although the top Tapestry Segments where

TABLE 2 ➤ Top Tapestry Segments and LifeModes, by Freshman Cohort Year, 2018–2022

Year	Tapestry Segment	%	LifeMode	%
2022	Up and Coming Families	32.92	Sprouting Explorers	32.62
	Workday Drive	19.23	Family Landscapes	23.00
	Southern Satellites	10.38	Rustic Outposts	19.77
	Rooted Rural	5.69	Cozy Country Living	7.46
	Middleburg	4.08	Middle Ground	4.23
2021	Up and Coming Families	32.07	Sprouting Explorers	31.91
	Workday Drive	20.30	Family Landscapes	26.30
	Southern Satellites	11.37	Rustic Outposts	20.85
	Rooted Rural	5.85	Cozy Country Living	4.82
	Middleburg	5.21	Affluent Estates	4.03
2020	Up and Coming Families	32.66	Sprouting Explorers	32.17
	Workday Drive	18.03	Family Landscapes	23.04
	Southern Satellites	10.19	Rustic Outposts	17.62
	Rooted Rural	5.01	Affluent Estates	5.58
	Middleburg	4.37	Cozy Country Living	5.50
2019	Up and Coming Families	33.27	Sprouting Explorers	33.27
	Workday Drive	16.63	Family Landscapes	22.38
	Southern Satellites	10.21	Rustic Outposts	18.32
	Rooted Rural	5.54	Middle Ground	7.03
	Middleburg	5.27	Cozy Country Living	4.33
2018	Up and Coming Families	29.86	Sprouting Explorers	29.74
	Workday Drive	15.97	Family Landscapes	21.33
	Southern Satellites	8.86	Rustic Outposts	18.68
	Middleburg	4.91	Cozy Country Living	7.67
	Rooted Rural	4.29	Hometown	6.15

the majority of the APSU freshman cohort permanently reside will be highlighted later in the paper.

According to Esri (2021), the fourteen LifeModes are uniquely defined based on demographic, geographic, ethnographic, and sociographic variances. Within these LifeModes are contained subordinate Tapestry Segments—each containing distinctive characteristics, but are similar to the broader LifeMode under which they fall.

Analysis of the permanent address data over the five-year period through the Esri GIS system revealed that APSU's freshman cohort reside within more than 40 of the possible 67 Tapestry Segments. More than 70 percent of these students, however, are concentrated within only five Segments. Similarly, when these students were placed into the broader LifeMode groups, more than 75 percent were concentrated into only three areas. These concentrations clearly demonstrate the consistency by which the institution is attracting its first-time freshmen and allows it to develop clear plans for the future.

Shown in Table 2 are the top five Tapestry Segments and LifeModes for each of the five freshman cohorts. It is clear that the top three Tapestry Segments and LifeModes showed little change during the five-year period, while the percentage of distribution among these top groupings shows modest change. The Tapestry Segment "Up and Coming Families" along with its matching LifeMode of "Sprouting Explorers" are clearly at the top and have shown moderate increases since 2018. The Tapestry Segment "Workday Drive" with its matching LifeMode "Family Landscapes" are the next strongest area, but have shown modest increases over the last five years.

Within the Tapestry Segments, only "Middleburg" and "Rooted Rural" change places in 2018. The rest stay the same. Among the LifeModes, there is some movement within the fourth and fifth spots with "Affluent Estates" overtaking "Middle Ground" for a couple of

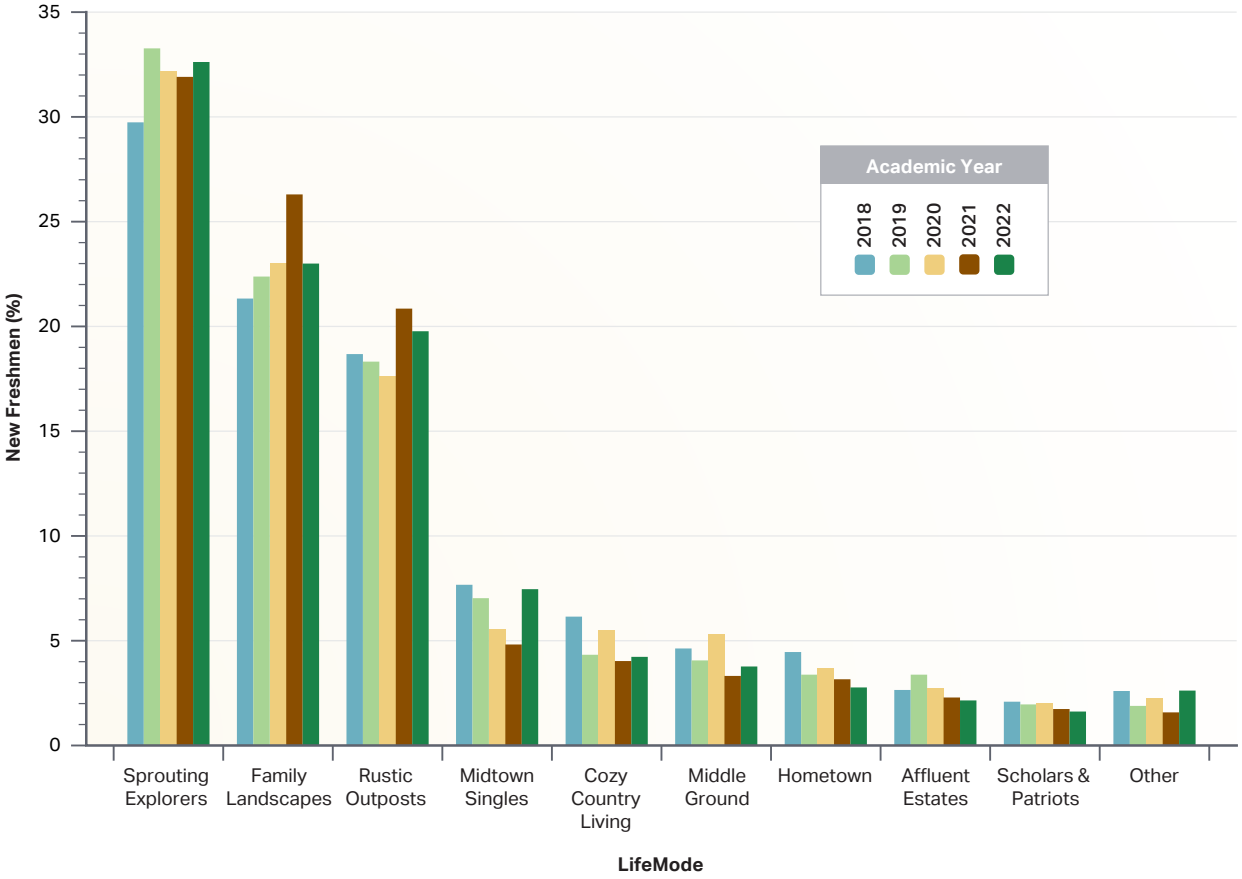

FIGURE 4 ➤ Zip Code Marketing of New Freshmen, Five-Year Trend by LifeMode

years. By observing trends over the past five years, it is clear to see in Figure 4 that, not only are there more of the APSU cohort coming from the "Sprouting Explorers," "Family Landscapes," and "Rustic Outposts" groups, these three groups rank consistently higher for all five years.

While it is important to understand where the institution's new freshmen are coming, it might be equally important to see those areas were increases could be realized. In looking at the graph, it is clear that "Midtown Singles" is another area where the institution could be looking. As noted in the graph, there was an overall increase in this group of students during 2022. This group includes the Tapestry Segments of "City Strivers," "Young and Restless," "Metro Fusion," "Set to Impress," and "City Commons." Furthermore, the "Cozy County Living" and "Middle Ground" groups could also provide area of increase student enrollment.

Future Marketing Endeavors

This study looked at five years of APSU's freshman cohort and compared students' permanent residence against the Esri system in order to gather demographic and sociographic information. The results of the study indicate that, out of the fourteen LifeModes established by Esri, ASPU freshmen were mainly concentrated into "Sprouting Explorers," "Family Landscapes," and "Rustic Outposts." Also, out of the 67 possible Tapestry Segments, APSU freshmen were mainly concentrated into "Up and Coming Families," "Workday Drive," and "Southern Satellites."

Furthermore, it was determined that, among the top five Life Mode groups where the heaviest concentration of APSU's freshman cohort permanently resided, there has been little change during the five-year period. With

this information, DSIR was able to generate a list of potential target markets within a 200-mile radius of APSU.

Additionally, Esri has provided individual four-page profiles of each Tapestry Segment group to include population growth, home ownership, types of occupations, household budget, as well as other demographic and sociographic data.

By combining the target market list with the group profiles, the APSU enrollment management team should be able to not only pinpoint various areas they would like to focus scarce resources on, they should also be able to create unique marketing plans for each of the three LifeMode groups.

Recommendations

To show an example of how these data may be used, the most heavily concentrated area where APSU freshmen are coming from is in the "Up and Coming Families" group. Accordingly, this group consists of many young, Hispanic homeowners with families in multi-generational households. Furthermore, most within this group are considered hard-working and optimistic, and most residents aged 25 years or older have a high school diploma or some college education. Conversely, APSU's overall enrollment of Hispanics averages 838 over a five-year period and has shown a steady increase. Currently, they make up an average of 8 percent of APSU's total population.

An added benefit to concentrating on the "Up and Coming Families" group is in the promotion of the non-traditional learner because many families within this group as well as the "Sprouting Explorers" LifeMode tend to live in multi-generational households. A listing of all LifeMode and Tapestry Segment profiles can be found on ESSRI's website.

Another example of how the data could be used within enrollment management can be found in the "Family Landscapes" LifeMode group where the median home value is slightly higher than the U.S. median home value and where there are two workers in the family, contributing to the second highest labor force. Most people in this group work in healthcare, management, and sales, making this area a good choice for the College of Business and the College of Behavioral and Health Sciences.

Below are specific marketing strategies that can be utilized with the data provided within the appendices:

- **Academic Outreach**—Establish relationships within the middle schools and high schools within each of the targeted zip codes. These relationships could include counselors, teachers, and alumni. APSU could specify that it is promoting specific academic programs that serve the targeted demographic.
- **Traditional Media Outreach**—Highlight academic programs, news events, and stories of interest to the local media within the targeted zip codes. Target traditional media advertising (radio, television, billboard) to reach the specific demographic group represented by the Tapestry Segment.
- **Social Media Outreach**—Utilize the advertising manager tool for all social media to capture the key demographic components within the Tapestry Segment for that zip code. Examples of the types of demographic components that could be used include gender, ethnicity, aggregate financial information, popular professions, and lifestyle factors.
- **Specific Program Marketing**—By utilizing advertising manager tools to identify popular interests, searches, and key words, individual program marketing materials could be directed specifically to the individual who is most likely to show interest in the program. This could range from social media advertising to direct mail campaigns.
- **Combine Resources**—By utilizing the data provided within the appendices of this report with the institution's customer relationship management (CRM) system, greater concentration could be given to those areas that are seeing application activity to encourage more application submissions.

Conclusion

In the highly competitive world of enrollment management, admissions professionals need to not only use the marketing tools readily available to them; they should also seek out other methods that are either innovative or new to the enrollment management profession. This

dynamic geo-spatial system can create maps, focus on targeted areas, and more effectively exploit student enrollment data to seek a better understanding of future trends. By utilizing the Esri system into the strategic enrollment management strategy, admissions professionals can gain a greater understanding of their current market, focus on specific demographic or sociographic trends within those markets, and discover potential new market niches.

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