

Basic Business Environment Analysis

Using thematic maps to find opportunities and threats

—by Fred L. Miller

Introduction

Problem

Janice Brown and Steven Bent plan to open a new home center in the Minneapolis-St. Paul area. The center, called *Living in the Green Lane*,¹ will offer a variety of environmentally friendly building products, home improvement products, and construction technologies.

To develop a business plan for this enterprise, Janice and Steven must analyze the market environment in the Twin Cities area to determine if this area will support such an enterprise. This analysis involves seeking out "green" customers, identifying potential competitors, examining transportation patterns, and pinpointing retail centers that draw consumer traffic.

Janice and Steven have discovered that green customers tend to have higher levels of income, education, and home value than the general population of the United States. They have directed you, in your capacity as the firm's business geographic information system (GIS) analyst, to use GIS resources to explore the distribution of households with these characteristics in the Minneapolis-St. Paul market area to determine if it can support their business plan.

Specifically, you will use color-coded mapping and symbology tools to map these relevant demographic characteristics in the planned market area.

¹ The organizations and people in this SpatialLAB are fictional. Any resemblance to actual individuals or organizations is coincidental.

Location

Minneapolis-St. Paul core-based statistical area

Time to complete the lab

Four to six hours

Prerequisites

An understanding of the importance of environmental scanning in the process of developing marketing strategy

Access to Esri Business Analyst™ Desktop Premium 10

Data used in this lab

- Demographic and consumer spending data at various levels of geography
- Major highways and streets
- Business listings
- Shopping center listings

Student activity

This lab focuses on environmental scanning and market area analysis. The basic environmental scanning question is whether a market area offers a substantial potential market for the firm's products and services. This question is inherently spatial. The service area for the enterprise is spatially limited, while clusters of attractive consumers are distributed unevenly across the market area. The question then becomes whether there are clusters of attractive customers of sufficient size to support the enterprise.

In this case, Janice and Steven have identified several segments of green consumers, some of whom are motivated by environmental concerns and others who require rapid payback of investments in green technologies from energy savings. They believe the most attractive segments will be True Blue Greens consumers, who are largely in the first category, and Green Back Greens consumers who are in the second (Schaefer 2007). Demographically, these segments are characterized by higher levels of income, education, and home value than the general population in the United States

(Kannan 2007). These are the characteristics you will use to assess the ability of the Minneapolis-St. Paul market area to support a *Living in the Green Lane* store.

In this lab, you will focus on displaying, classifying, and symbolizing the distribution of these key demographic characteristics across the Twin Cities area using wizards and GIS layer properties. Specifically, you will use these tools to

- Focus on the Minneapolis-St. Paul market area.
- Extract data on the demographic characteristics that distinguish this firm's target customers.
- Use various symbology, labeling, and formatting tools to display this data in map layers.
- Use data normalization and classification schemes to represent this data meaningfully.

At the conclusion of this lab, you may be required to submit written answers to the questions in the exercises or prepare a written project covering both the basic and advanced labs comprising business environment analysis.

Conventions used in the data

CBSA Core-based statistical area

CY Current-year data

FY Future-year projections, which are five years beyond the current year

HH Household

Prepare your workspace

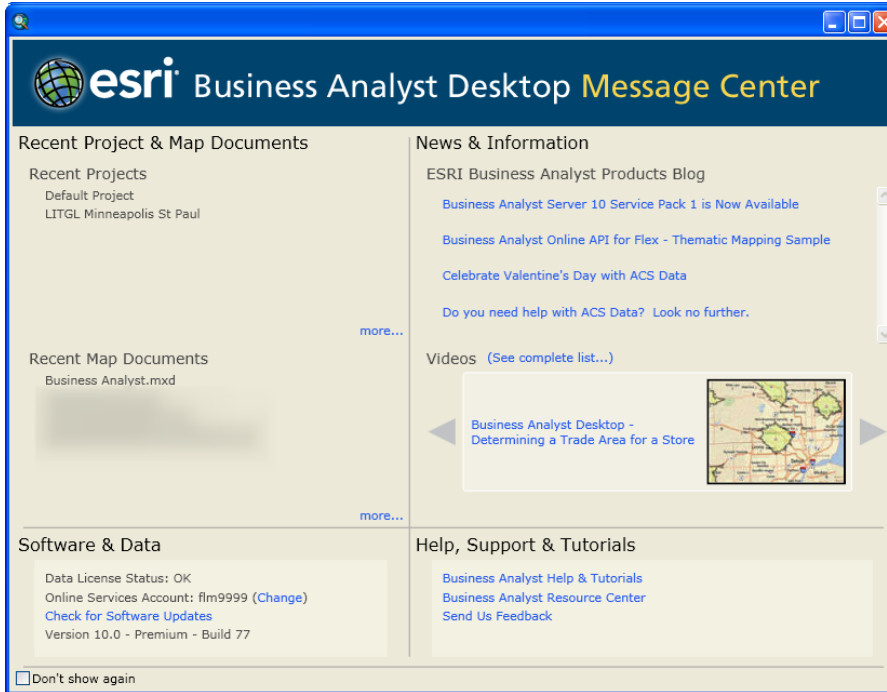
This lab uses Business Analyst™ Desktop Premium 10 to perform the analysis. To prepare for it, you should confirm that this software is available on your workstation.

OPEN A PROJECT AND CREATE A STUDY AREA

You will use Esri® Business Analyst to provide a range of tools for performing color-coded (also called thematic) mapping and managing the symbology with which data is displayed.

- 1 If you have not already done so, copy the *LITGL Minneapolis St Paul* project folder to the `C:\My Output Data\Projects\` folder on your hard drive.
- 2 Click *Start » Programs » ArcGIS » Business Analyst » BusinessAnalyst.mxd* to run ArcMap™.

- 3 Load *Business Analyst Extension*, load the default map, and display *Business Analyst Desktop Message Center*.
- 4 Under *Recent Projects*, click the *LITGL Minneapolis St Paul* project to select it and close *Message Center*.



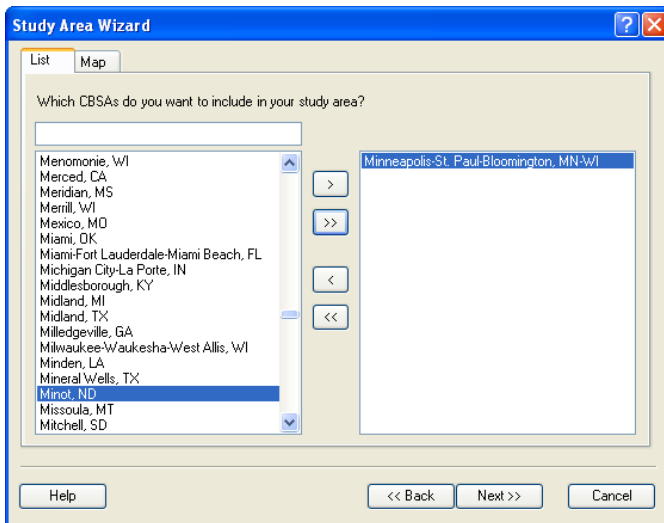
Your screen will resemble the default map below. It displays a map of the United States and several of the country's major cities. Notice in the *table of contents* on the left that the map has three group layers named *Business Analyst Network Barriers*, *Business Reference Layers*, and *Map Layers*. *Map Layers* includes several additional group layers, each composed of several layers whose visibility depends on the scale and the extent of the map.

You may toggle the display of all the layers in a group layer by selecting and unselecting the group layer title. In addition, you may expand or contract the group layers to control how much of the *table of contents* is visible. The same is true of individual layers. For example, turn on and expand *Demographic Layers*. Then expand the *State Areas* layer to view the *Legend* for the current map, which indicates that it is displaying state values for *Median Household Income*.



The project file for your work is ready. Within it, you will now define a study area for your analysis—in this case, the *Minneapolis-St. Paul-Bloomington core-based statistical area*.

- 5 Click the drop-down box on the toolbar and click *Study Area* to open *Study Area Wizard*. In the first screen, select *Create New Study Area* and click *Next*.
- 6 Select *By CBSA* from the available options, select *From a list*, and click *Next*. Select *Minneapolis-St Paul-Bloomington, MN-WI* from the options, move it to the right box with the arrow key, and click *Next*.



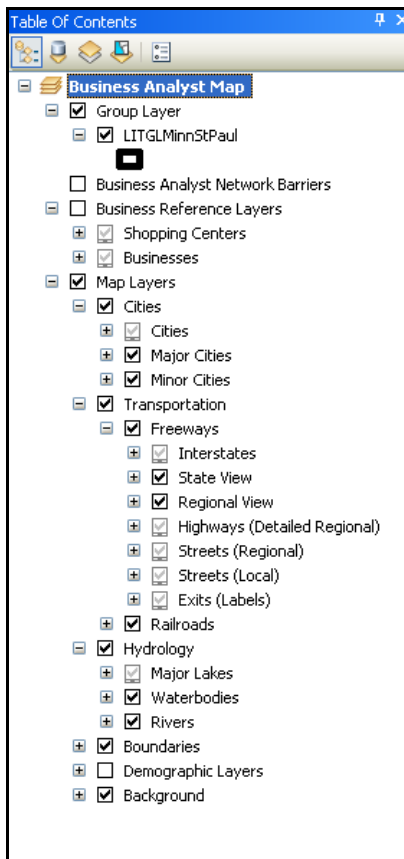
- 7 Enter **LITGLMinnStPaul** in the *Name* box and an appropriate description in the *Comments* box.
- 8 Click *Finish*.

Several things happen. The map zooms to the study area you have created, which is outlined in a bold border. It is also added as a new group layer to the *table of contents*. Within the study area, major freeways and the boundaries of the Minneapolis-St. Paul area are displayed.

Look at the *table of contents* to see why.

9 Expand *Freeways* under *Transportation* in the *Map Layers* group layer.

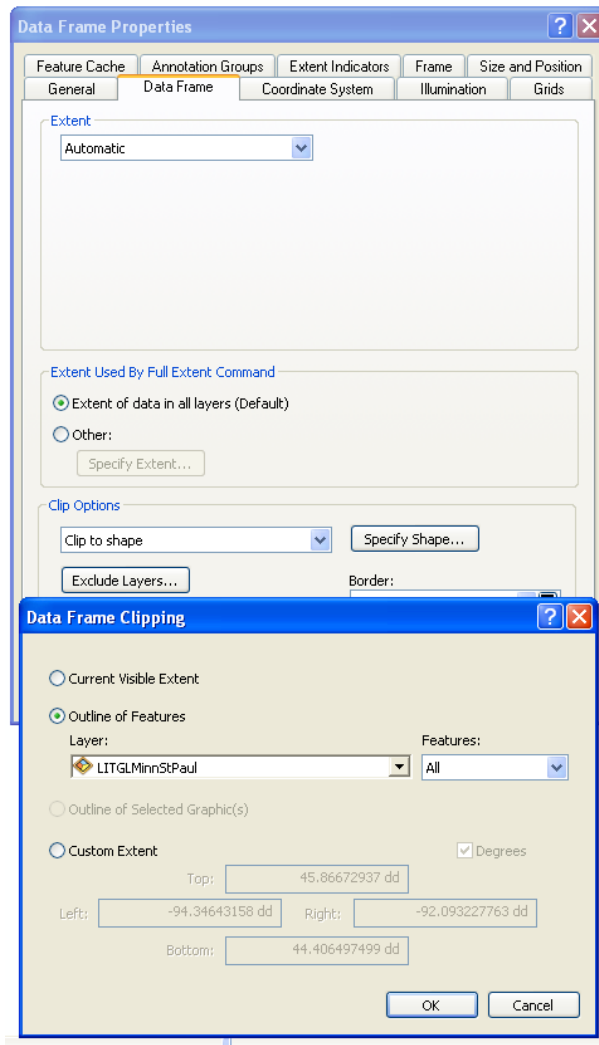
Note the difference in the selection boxes for the *State View* and *Interstates* layers. The lighter color and small bottom bar of the *Interstates* and *Streets (Regional)* layers indicate that they are available but not displayed at all scales. This scale dependency, which you can customize in a layer's properties, means that different layers will be displayed as you zoom in and out of the map. These settings ensure that the more detailed layers appear only on larger-scaled maps, where they are more discernible and useful.



You have created a project and study area for this study. You will now clip the data layers in the *table of contents* to the shape of the study area. This will make your thematic maps easier to read and concentrates users' attention on the area of interest.

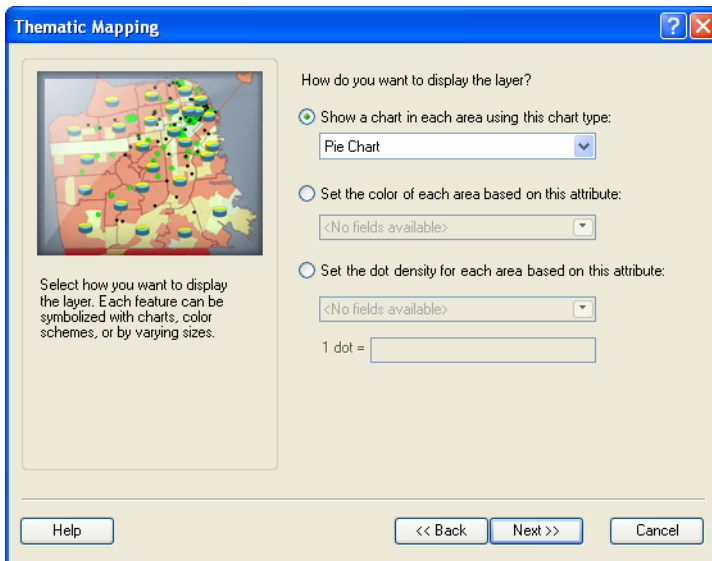
10 Right-click anywhere in the map area. Click *Data Frame Properties* and then click the *Data Frame* tab.

- 11 In the bottom half of the dialog box under *Clip to shape*, select *Enable* and click the *Specify Shape* button. On the *Data Frame Clipping* dialog box below the *Data Frame Properties* box, select *Outline of Features*, and then select *LITGLMinnStPaul* in the *Layer* box.
- 12 Click *OK* and then click *Apply*.



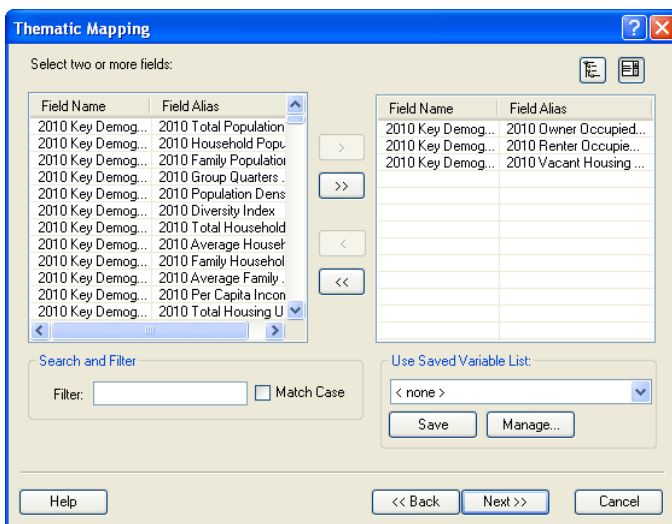
All the features have been clipped to the boundaries of the study area, which appears against a blue background. You will change the background color to white.

- 13 On the *Data Frame Properties* box, click the *Frame* tab and, about halfway down, click the drop-down arrow to the right of the *Background* box. Set the background color to white. Click *OK* to apply the setting and close the box.



- 5 Select the attributes *Current Year (CY) Owner Occupied HUs*, *CY Renter Occupied HUs*, and *CY Vacant Housing Units* in the box on the left side of the window.
- 6 Click the single arrow button to move these attributes to the right box to include them in each pie chart. Click *Next*.

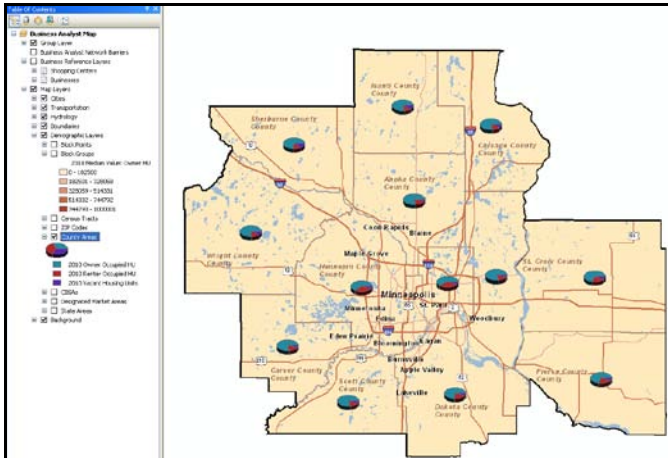
The attribute names here use CY for current-year data and FY for future-year projections. The GIS provides annual updates for its demographic and Tapestry™ Segmentation datasets; the data names listed in the images in this lab may include years different from those you encounter in the software. The CY/FY convention, therefore, will allow you to use the appropriate data attributes in spite of this variation.



- 7 Select a color scheme from the available options and then click *Finish*.

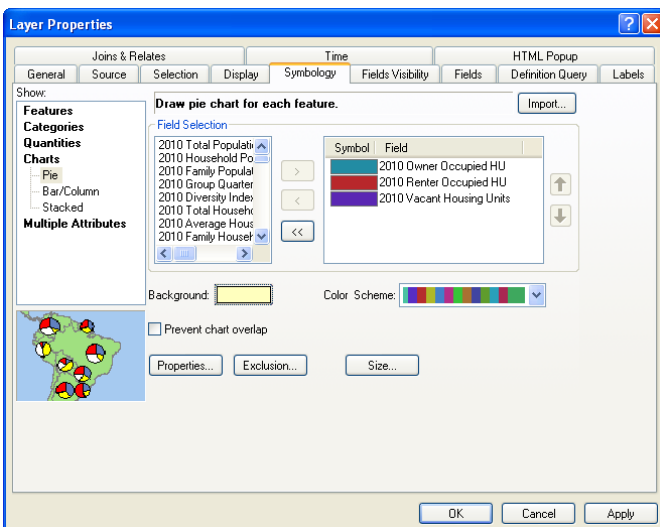
The wizard will process your settings and produce a map of the counties in the Twin Cities CBSA. Each county contains a pie chart displaying the portion of housing units occupied by owners and by renters as well as vacant housing units. Your map should resemble the one below, though the colors may differ.

If this map isn't displayed immediately, confirm that the Demographic Layers group layer is turned on and that only the County Areas layer is turned on.

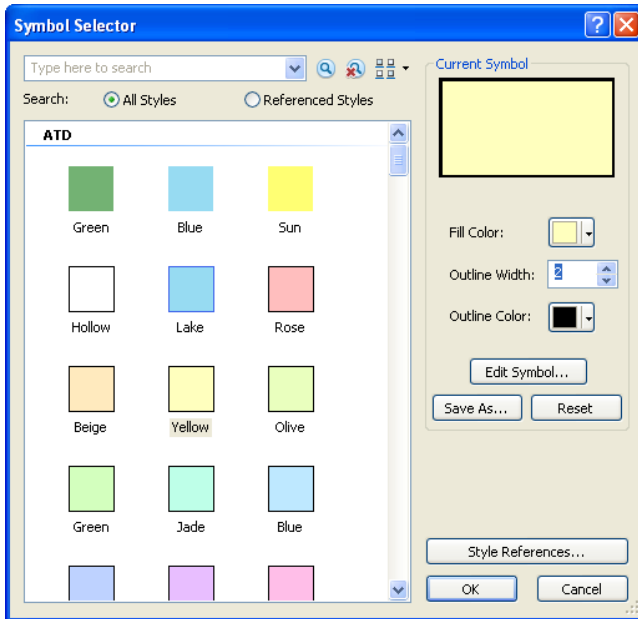


Data for each county is displayed by pie charts, but several of these pie charts are hidden behind other features and county boundaries and are not clear. You will turn several layers off and adjust the properties of the *County Areas* layer to correct this.

- 8 In the *table of contents*, uncheck the boxes to the left of the *Transportation* and *Hydrology* layers to turn them off and make the map less cluttered.
- 9 Double-click the *County Areas* layer to open its *Layer Properties* window, which will display the *Symbology* tab. Click the colored box just to the right of the *Background* field to open the *Symbol Selector* window.

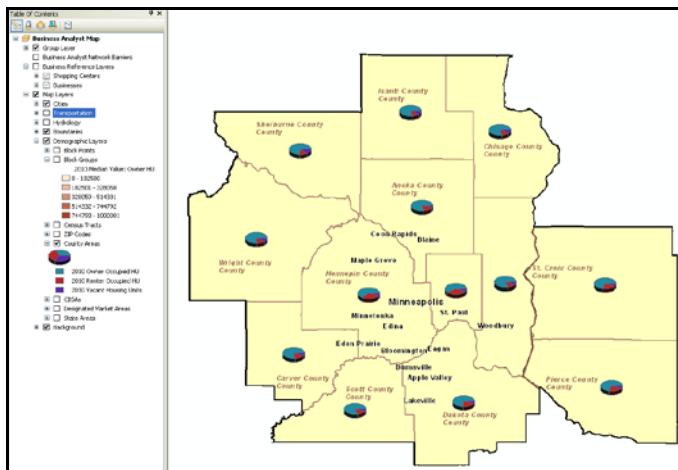


- In the *Symbol Selector* window, set *Outline Width* to 2 pixels and *Outline Color* to *Black*. The window should resemble the one below:



- Click *OK*.

The map will now resemble the one below, though the colors may vary:

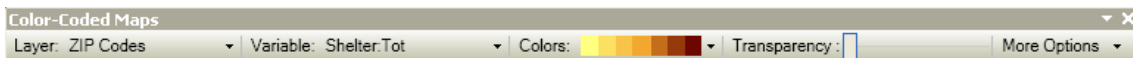


Review the charts for each county. For *Living in the Green Lane*, homeowners, who are more likely to invest in major projects than are renters, are primary target consumers. Renters are a secondary market with interest in making smaller investments in energy-saving technology to lower utility costs. While there are variations in the percentage of owned homes across the area, this map indicates that the overall level of homeownership is high, a favorable market indicator for the firm.

CREATE A MAP OF MEDIAN HOME VALUE

Home value is another dimension of the green consumer profile identified by Janice and Steven. Owners of high-value homes are more likely to invest in environmentally friendly renovations and to have the financial resources of income and home equity lines of credit to allow them to do so. You will create a thematic map of median home value to display the distribution of this attribute within the study area.

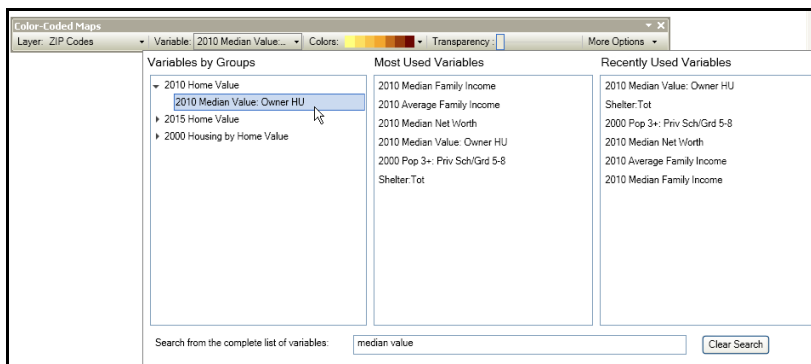
- 1 Uncheck the County Areas layer to turn it off. Expand the drop-down menu of the toolbar, click Maps, and then click Show/Hide Color-Coded Maps Toolbar.



The toolbar opens on top of your map. You may dock it to other parts of the user interface if you wish.

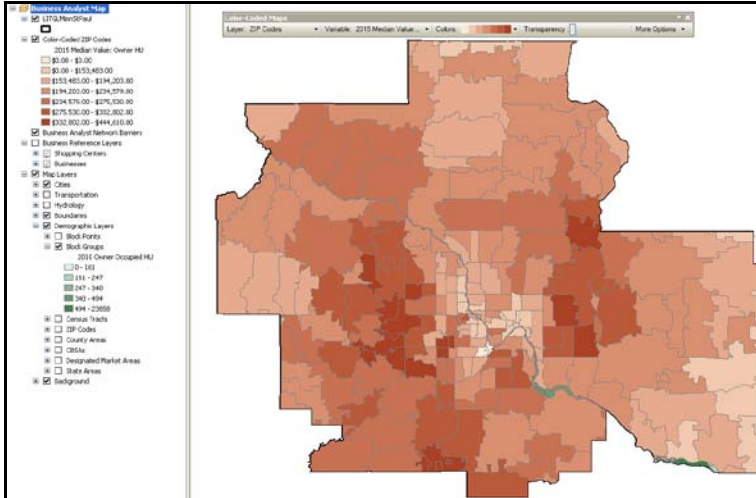
- 2 Expand the drop-down box for the *Layer* field. Note that some geographies are available for selection, while others provide the option to zoom in to see them. This scale dependency is designed to present attribute data at geography levels appropriate to the map's scale.
- 3 Select *ZIP Codes* as the layer you wish to symbolize. A new layer is added to the *table of contents*, and the map display is updated.
- 4 Expand the drop-down box for the *Variable* field to reveal a list of attribute groups in the project dataset. Expand and contract these groups to review the range of data available for color-coded mapping.
- 5 You wish to map home value, so enter **median value** in the *Search* field at the bottom of the window, and then select *CY Median Value: Owner HU* as the variable to map.

The map is immediately updated. Your window should resemble the one below, though your lists, *Most Used Variables* and *Recently Used Variables*, will be different.



- Expand the *Colors* drop-down box and select a color ramp with which to display the chosen data. When you select a new color ramp, the map is immediately updated.

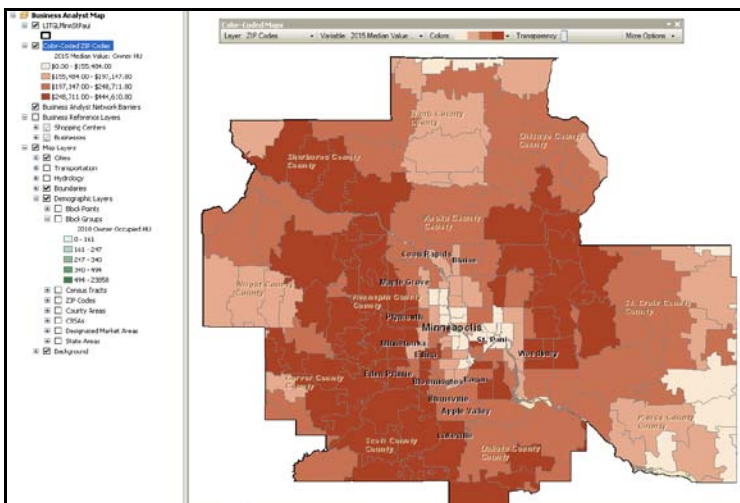
Your map should resemble the one below, though your color choice may vary:



Look at the legend of this map in the *table of contents*. There are several levels in the layer classification scheme, but it is not clear how they were derived. Moreover, variations in color are difficult to distinguish on the map, and some classes seem to include very few ZIP Codes, a function of the *Natural Breaks* classification scheme. You will adjust the classification scheme to enhance the map's communication value.

- Expand the *More Options* drop-down list at the right of the *Color-Coded Maps* toolbar.
- In the drop-down box for the *Method* field, select *Quantile* as the classification method. In the drop-down box for the *Classes* field, select *4* as the number of classes.

Your map will be redrawn immediately to resemble the one below, though your color scheme might vary:



Notice that the number of classes has been reduced to four and the map is easier to understand. The number of ZIP Codes in each class seems more balanced. In the *Quantiles* classification method with 4 *Classes*, the selected geographic units within the map's extent are divided into four classes each with the same number of units, plus or minus one. Thus, the units with the two darkest colors are above the median value for this variable, and those with the lightest two colors are below it.

- 9 Check the box to the left of the *County Areas* layer to turn it on. The pie charts you created in that layer now appear on top of the new map. This allows you to explore homeownership and home value patterns simultaneously. As you may wish to return to this point in your analysis, you will set a bookmark here.
- 10 Click *Bookmarks* on the menu bar and then click *Create* to open the *Spatial Bookmark* dialog box. Enter **HomeOwnValueMap** as the bookmark name and click *OK*.
- 11 Click *Bookmarks* again to confirm that this bookmark appears in the initial list under the *Manage* command.
- 12 Click *File* » *Save* or the *Save* icon to update the saved version of the map.

Use these maps to answer the following question in your project report:

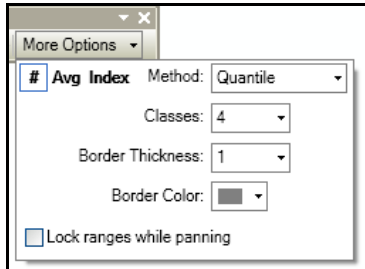
Question 1: *What variations in homeownership and median home value do you observe in this study area? Which parts of the region are most attractive for Living in the Green Lane? Why?*

CREATE A MAP OF HOME MAINTENANCE EXPENDITURES

You also wish to examine the level of home-related expenditures in the Twin Cities area. To do so, you will create a thematic map displaying the average home maintenance materials purchases per homeowner. You will use the mapping options of the *Color-Coded Maps* toolbar to do so.

- 1 Expand the drop-down box for the *Variable* field to reveal a list of attribute groups in the dataset.
- 2 Enter **remodel** in the *Search* field. Expand the *CY Consumer Spending* category and then click *Home Imp Material-Own & Rent: Tot:Tot* (total purchases of home improvement materials by homeowners and renters). The map updates immediately.
- 3 Expand the *Colors* drop-down box and select a color ramp with which to display the chosen data. When you select a new color ramp, the map is immediately updated.
- 4 Expand the *More Options* drop-down list at the right of the *Color-Coded Maps* toolbar. Confirm that *Quantile* is selected in the *Method* field and 4 is selected as the number of classes.

Note the options in the upper left of the *More Options* window. These allow you to select whether you wish to map this attribute as total expenditures in each geographic area, average expenditures per household in that area, or an index related to the average national value for that attribute. The last of these options, *Index*, the national average level of household expenditures, is assigned a value of 100. Geographic units with indexes over 100 spend at a level above that national rate; those with indexes below 100 spend at a level below that rate.



5 Select each of these options and notice the effect on the map. When you are finished, select the *Avg* option to move to the next step.

6 Expand the *Layer* field drop-down box.

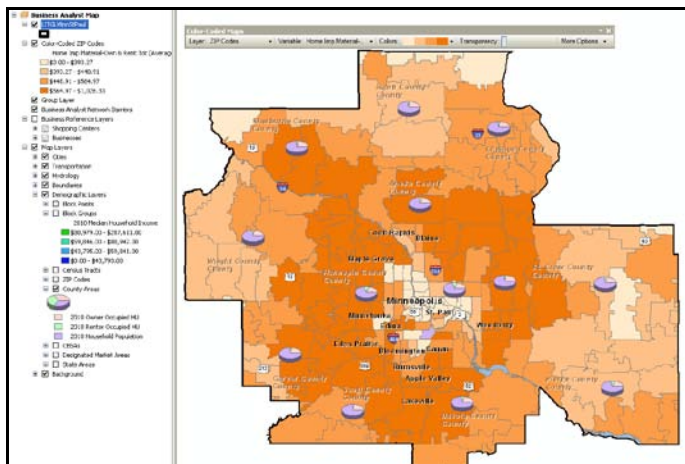
Notice that you must zoom in to display the purchasing data at the block group level.

7 Click the *Zoom In* option to do so.

8 Pan around the map and notice that the class boundary values in the legend change as you do so because the quantile classification method is applied to the block groups in the map's current extent.

9 To retain the same values as you pan, expand the *More Options* drop-down list and select the *Lock ranges while panning* option. This allows you to pan around the block group map without changing the range boundaries displayed in the layer's legend.

- 10 Return to the *ZIP Code* layer and zoom out to view the entire study area. Your map should resemble the one below, though your color scheme might vary:



You wish to save the *Color-Coded ZIP Codes* layer for use in other projects.

- 11 Right-click the *Color-Coded ZIP Codes* layer to save the layer for use in other projects.
- 12 Click *Save as Layer File* and navigate to *C:\My Output Data\Projects\LITGL Minneapolis St Paul\CustomData\ChapterFiles\Chapter2*. Then save the layer file as *ZIPHomeExpenditures.lyr*.

You may now add this layer to this or any other map document by clicking the *Add Data* button, navigating to this folder, and double-clicking this layer file.

- 13 Save the map file again to preserve your work.

Use the ZIP Code and block group color-coded maps you created to explore the patterns of home improvement expenditures in the Minneapolis-St. Paul area and answer the following question:

Question 2: *What is the difference between mapping total home improvement expenditures by ZIP Code and average home improvement expenditures per household by ZIP Code? How can each help you understand the distribution of these expenditures in the market area?*

You have now created maps displaying the patterns of homeownership, home value, and home-related expenditures per household in the Twin Cities area. Review these maps to identify concentrations of high home values and/or home-related expenditures. These represent areas of opportunity for *Living in the Green Lane*. You must now create a layer displaying the distribution of household income to include this dimension of the green consumer profile.

CREATE A MAP OF HOUSEHOLD INCOME

With business GIS software, thematic mapping may also be performed with *Symbology* options in the *Layer Properties* window. Now you will use this approach to create thematic maps of household income at the block group level in the Twin Cities core-based statistical area.

- 1 Turn off the *County Areas* layer.
- 2 Right-click the *Block Groups* layer and click *Properties* (or double-click the layer) to open the *Layer Properties* window. Click the *Symbology* tab.
- 3 In the *Value* box, select *CY Median HH Income*.
- 4 Click *OK* in response to the *Maximum sample size* message.
- 5 To the right of this box, click the *Classify* button to open the *Classification* dialog box.

The *Classification* dialog box provides significant information about the data values for this attribute. The top right of the box presents descriptive statistics for the attribute. Note that it includes 10,000 records, a sampling of the block groups in the dataset, which are themselves a small part of the more than 200,000 block groups in the United States.

You may increase this sample size by clicking the *Sampling* button. The graph in the bottom left of the box displays the distribution of values for the attribute. The lines represent the class boundaries of the current classification scheme. The corresponding values are listed in the box to the right.

Try moving one of the lines with your mouse or entering values directly into the list.

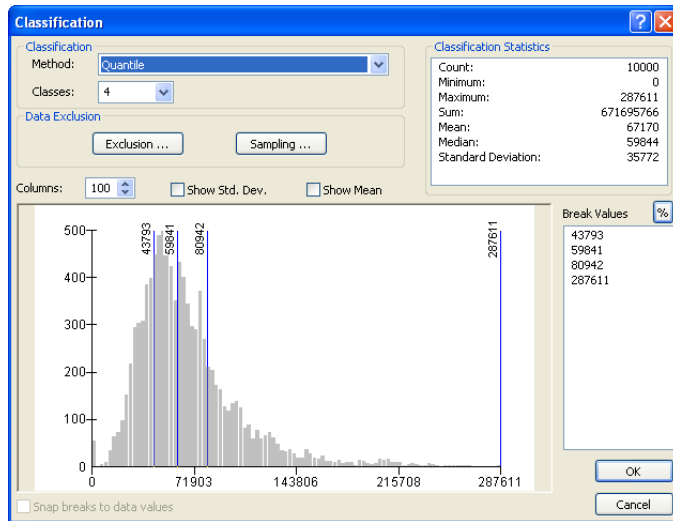
The classification scheme changes to *Manual*, and the class boundaries are adjusted accordingly. This allows you to customize class boundaries to specific values of importance to your project. By clicking the *Mean* and *Standard Deviation* options, you may elect to display these statistical measures as lines in the distribution chart.

Note the *Classification Method* and *Classes* boxes at the top left of the dialog box. These allow you to set the classification method and number of classes for the map. When you change these settings, the revisions are immediately reflected in the chart and *Break Values* box.

Experiment with different methods and numbers of classes to see the impact of these settings. You may even wish to click *OK* and *Apply* to see the impact of these changes on the map.

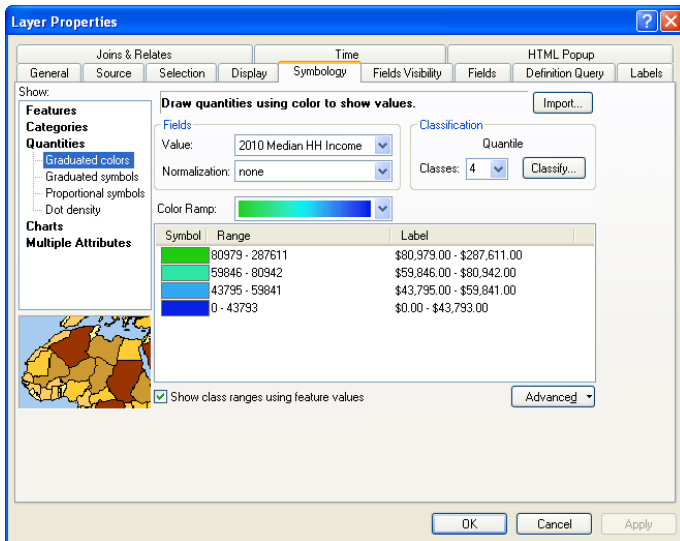
You wish to display median household income in a quartiles method with half the features above the median feature value and half below.

- 6 Select *Quantile* in the *Methods* box and *4* in the *Classes* box, the same settings you used earlier on the *Color-Coded Maps* toolbar.
- 7 Click *OK* to return to the *Symbology* tab of the *Layer Properties* window.

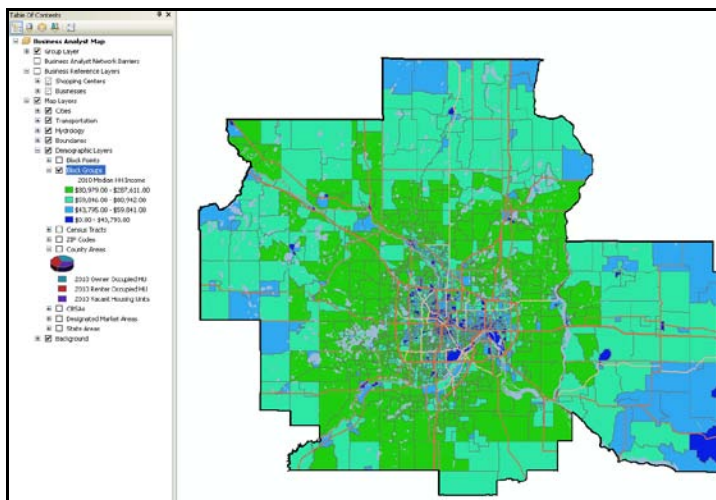


- 8 In the *Color Ramp* box, select a *Green to Blue* color scheme.
Note that attribute values are listed from highest to lowest.
- 9 As you wish the higher values to be displayed in green, click the *Range* column header and click *Reverse Sorting*.
- 10 Click the *Label* column header to the immediate right of the *Range* column header and click *Format Labels*.
- 11 In the resultant dialog box, click *Currency* and then click *OK*.
- 12 Check the *Show class ranges using feature values* box below the *Symbol* column to use actual values in the data as class boundaries.

The *Symbology* tab should resemble this:



- Click *OK* to close the *Layer Properties* box and apply the settings to the map. Your map should resemble the one depicted:



Use the thematic maps you have created to answer the following question in your project report:

Question 3: *What variations in median household income and home maintenance expenditures do you observe in this study area? Which parts of the region are most attractive for Living in the Green Lane? Why?*

Submit your work

Submit answers to the following questions:

Question 1: *What variations in homeownership and median home value do you observe in this study area? Which parts of the region are most attractive for Living in the Green Lane? Why?*

Question 2: *What is the difference between mapping total home improvement expenditures by ZIP Code and average home improvement expenditures per household by ZIP Code? How can each help you understand the distribution of these expenditures in the market area?*

Question 3: *What variations in median household income and home maintenance expenditures do you observe in this study area? Which parts of the region are most attractive for Living in the Green Lane? Why?*

Credits

Data

Data displayed in screens captures of Business Analyst is courtesy of Esri; the US Census Bureau; Infogroup; the Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK Mediamark Research & Intelligence, LLC (GfK MRI); and Market Planning Solutions, Inc.

Instructor resources

Contextual information

This lab is written for business students in an integrated business GIS course at the undergraduate or graduate level. It may be used to replace the exercises in chapter 2 of *Getting to Know ESRI Business Analyst* in labs with Business Analyst Desktop Premium 10 installed. The emphasis is on the spatial analysis of factors that determine the attractiveness of a market area for a specific enterprise relative to its marketing strategy and objectives. This is a common objective of the environmental scanning and market planning process, especially for startup entrepreneurial firms. Thus, this lab is also useful as a stand-alone exercise in entrepreneurship or marketing strategy courses.

This lab shows how to map demographic and consumer expenditure patterns within a market area as well as the distribution of competing and supporting business entities across the area. It also shows how to identify attractive clusters of potential customers based on a set of defined characteristics.

Upon completion of the lab, students may be required to submit answers to several questions based on their observation of the thematic maps they have created.

Analysis and visualization tools

Business Analyst Desktop Premium 10 and the *Living in the Green Lane Minneapolis St Paul* project file are required to complete this exercise.

Data information

All the data for this exercise is provided by Business Analyst Desktop.

Data sources

Esri Business Analyst data

Answer key

Question 1: *What variations in homeownership and median home value do you observe in this study area? Which parts of the region are most attractive for Living in the Green Lane? Why?*

The counties in the central, southeastern, and eastern parts of the market area have the lowest rates of homeownership. Higher rates are displayed for block groups in the north, west, and southwest. Homeownership is above 50 percent of housing units across the market area.

The block groups with the highest median home values are largely in the southern half of the market area, with some concentration to the southwest. The block groups in the north of the market area display values in the middle two classifications, while those in the center of the market area are largely in the lowest classification.

Question 2: *What is the difference between mapping total home improvement expenditures by ZIP Code and average home improvement expenditures per household by ZIP Code? How can each help you understand the distribution of these expenditures in the market area?*

The total home improvement expenditures attribute reports total spending for the entire ZIP Code and is a good measure of market size. The average expenditures per household option divides this total by the number of households in each ZIP Code and is a measure of the level of spending in each individual household. In combination, these measures help Living in the Green Lane understand whether a market area offers a high number of households with low annual purchases or a small number of households with higher levels of purchases. This difference affects the merchandising and promotion strategies that Living in the Green Lane should use to serve potential customers.

Question 3: *What variations in median household income and home maintenance expenditures do you observe in this study area? Which parts of the region are most attractive for Living in the Green Lane? Why?*

The block groups with the highest levels of median household income are in an uneven ring outside the center of the market area, with a bit more concentration in the south. They are surrounded by block groups with medium income levels on the outside of the area. Block groups with the lowest levels of median household income are concentrated primarily, but not exclusively, in the central part of the market area.

The distribution of home-related expenditures per household follows the same pattern, indicating a potential relationship between these two attributes.

Additional notes

1. This SpatialLAB updates the student exercises in chapter 2 of *Getting to Know ESRI Business Analyst* (Miller 2010) for Business Analyst Desktop Premium 10. However, it may be used as a stand-alone exercise.

2. Though this lab is integrated with the *Advanced Business Environment Analysis* SpatialLAB to create a complete project, it is not necessary for students to complete that SpatialLAB to work with this one. Should you wish to use this lab as a stand-alone exercise, you should choose the reporting option of having students submit answers to the lab's questions, as they will not have sufficient information to complete a full project report.
3. It is useful for students to experiment with different classification schemes for these data layers, noting how changing the classification scheme can change the visual impression of the mapped data while presenting exactly the same data.
4. This lab incorporates only a few of hundreds of available attributes. Encourage students to explore additional attributes by posing different scenarios in which different enterprises use varying combinations of attributes to define attractive customers.
5. The *Color-Coded Maps* toolbar allows you to create maps for *Market Potential Indexes* (MPI) attributes and additional consumer expenditure variables that are not available in the approaches described in this lab. This allows students to map a whole range of consumer values, behaviors, media consumption, and purchasing patterns that are of great interest to marketers. Invite students to select an MPI attribute such as HHS: Home remodeling done/yr (households remodeling their home in the past year); map the number, percentage, and index values for this attribute; and explain the relevance of each measure.
6. For several of the most common attributes, data is available from the 1990 and 2000 censuses as well as current-year estimates and five-year projections. In addition, some attribute data contains rates of annual growth or annual change in other attributes. Help students understand how these data resources can be used to track changes over time in key market area characteristics.
7. Instead of—or in addition to—answers to lab questions, you may wish to have students complete a more comprehensive report covering multiple labs. If so, you may wish to use the following structure and guidelines for that report. Feel free to adjust this format to your preferences or class requirements.

Report format

Aim for reports of about six to eight pages in length and consider the following format:

- I. **Introduction**—A summary of the circumstances addressed by the research project
- II. **Problem statement**—A statement of the problem addressed by the project
- III. **Data information**—A statement of the sources and dates of all data used in the analysis
- IV. **Analytical methods**—A description of the analytic procedures used and how they will help solve the problem
- V. **Research results** (the largest section of the project)—To include
 - A. Presentation of the results of the analysis
 - B. Exhibits such as the required maps, charts, and tables and any others you wish to include to clarify your report
- VI. **Conclusions and recommendations**—A recommended response to the problem based on the results of the analysis

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