Mapping the Northern Pines Girl Scout Council

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Abstract

The Girl Scouts Northern Pine Council wanted to know how the number of girls enrolled as Scouts varied over time. They were also interested in relating zip codes to Service Units. Using ArcView and Bureau of Census data, this paper looks at one method to determine and map changes in the number of girls in Scouting and how zip code boundaries relate to Service Unit boundaries.

Introduction

When you mention Girl Scouts to most people, the first thing that comes to mind is cookies. While cookie sales have been a part of Girl Scouts since the 1920's, Girl Scouts is much more than just cookies.

In 1907, Lord Baden-Powell formed the Boy Scouts as boys all over England were reading and following the book he wrote for the men in his regiment during the Boer War in South Africa. This book taught boys how to follow a trail, read a compass and how to survive in the wild. In 1909, a meeting of Boy Scouts was held at the Crystal Palace in London and several girls attended, saying they wanted to learn what the boys had been learning (BSA 2002). Lord Baden-Powell asked his wife, Lady Olave Baden-Powell to form the Girl Guides.

One of the women attending the early Girl Guide meetings was Juliette Gordon Low of Savannah, Georgia. She brought the idea of Girl Scouts to the US. Starting from 18 girls in the first troop in 1912, Girl Scouting in the US has grown to 2.8 million girl members today. As a member of the World Association of Girl Guides and Girl Scouts, Girl Scouts in America are part of the 8.5 million girl and adult members in 140 countries (GSUSA 2002).

Girl scouting is open to all girls ages 5 to 17. Currently there are over 233,000 Girl Scout Troops in the US, organized into 300-plus local councils. Each troop serves one of the five levels of scouting. These levels are both age-based and associated with school grades. Daisy Scouts are 5 to 6 years old or are in kindergarten. Brownie Scouts are 6 to 8 years old or in grades 1 to 3. Junior Scouts are 8 to 11 years old or in grades 4 to 6. Cadettes are 11 to 14 years old or in grades 7 to 9, while Senior Scouts are 14 to 17 years old or in grades 10 to 12 (GSUSA 2002).

Troops are organized into Councils to help coordinate training and activities. Each Girl Scout Council is the local affiliate with authority over Girl Scouting in a specific section of the country. Each Council is further divided

into Service Units, which include all girls, leaders and troops within that area (GSUSA 2002).

The focus of this study is the Girl Scouts Northern Pine Council (GSNPC) (Figure1).
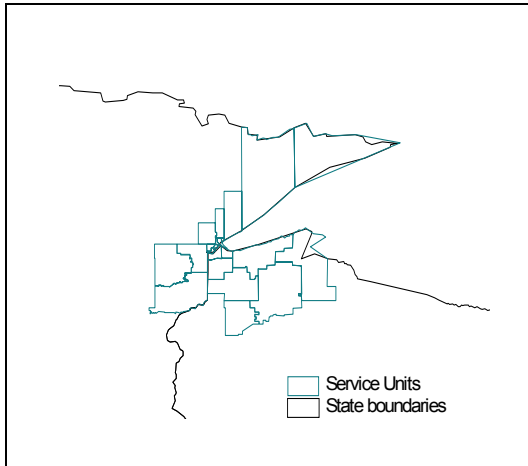

Figure 1. Northern Pine Girl Scout Council

Headquartered in Duluth, Minnesota, the GSNPC serves girls in ten counties in northwestern Wisconsin and northeastern Minnesota. Stretching from the Canadian border in Minnesota south to Hinckley, Minnesota and from Ashland, Wisconsin west to Superior, Wisconsin, and south to Hayward, Wisconsin, the GSNPC covers approximately 11,570 acres and is divided into 21 service units (GSNPC 2002). In the 1999-2000 school year, there were 2,825 girls registered in the different levels of Girl Scouting in the Council, out of 23,925 girls of scouting age in the various school districts contained in the Council boundaries (GSNPC 2002) (Figure 2).

To help local Girl Scout Councils identify areas of increasing or decreasing enrollment, the National Girl Scout Office sends each council a series of maps showing the changes in
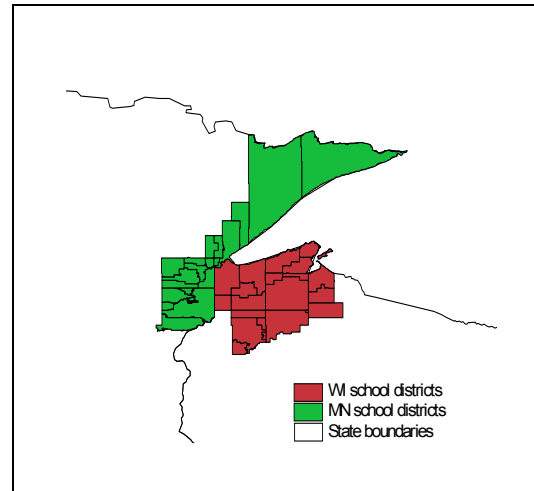

Figure 2. School Districts in GSNPC

the number of girls in the different Scouting levels by zip code boundaries. The GSNPC contains part or all of 112 different zip code areas. These maps either have an up or down arrow or a dot indicating changes. With the large number of zip code areas, this is not especially helpful since there is no information on identifying zip code areas with service units nor on handling multiple service units within a single zip code.

The GSNPC has enrollment data for each service unit in tabular form. For some of the service units the data is broken down by grade while in others only the total for each Girl Scout level is given. Every five years, GSNPC is required by the national office to project change for the next five years. At the time of this study, the base data was the 1990 census data (which was used in 1995) and that would be use again in 2000 as the reports are due before the 2000 census data becomes available. It did not make sense to use the same base data for five more years of projections given all the changes that have occurred in girl enrollment in the Council area. Additionally, the question of change over time was repeatedly asked without

an effective method to answer it. Even though data for a given year can be subtracted from previous year data but what happens over 2, 3, 4, or 5 years is harder to answer.

This study examines the change over time (1995 to 1999) in the number of girls in Scouting and attempts to relate zip codes to service unit boundaries in the Northern Pine Girl Scout Council.

Data Collection

The Girl Scouts Northern Pine Council (GSNPC) provided enrollment data for the 1995 to 1999 school years. These data included the number of girls in the associated school levels of scouting and the total number of girls in the different grade levels by service unit. Census Tiger data were used to identify the various school districts and zip code boundaries within the GSNPC area. Roads and county boundaries for the area were acquired in shapefile format from Environmental Systems Research Institute (ESRI).

Since a service unit is defined by the schools or school district and/or towns in an area (Table 1), it was necessary to geocode every school in the GSNPC.

Methods

Using the GeoCoding wizard in ArcView® 3.3, and the addresses of each school provided by GSNPC, the first attempt to geocode the 110 schools in the GSNPC was made. Forty-seven schools did not code with the first attempt. Twenty-four schools were interactively geocoded while the remaining twenty-three had a variety of problems. Superior,

Wisconsin, had the most difficulty with geocoding. Some of the major street names, such as Belknap in Superior, did not match the ESRI data as they were identified by highway number rather than by name. Some schools had PO Box or Rural Route addresses while one school

Table 1. Service Units by Schools or Towns.

Service Unit	Schools/Towns
Agate	Barnum, Cromwell, Moose Lake, Sturgeon Lake, Willow River
Chequemegon	Ashland, Bayfield, Benoit, Glidden, Grandview, Mason, Melon, Washburn
East Superior	Lake Superior, Great Lakes
Grand Marais	Grand Marais, Grand Portage, Tofte
Harbor Bay	Beaver Bay, Brimson, Finland, Isabella, Knife River, Schroeder, Two Harbors
Heritage Heights	Birchwood, Grant, Lowell, Nettleton, Summitt, Kenwood Edison
Hill and Dale	Lincoln, Piedmont
Indianhead	Shell Lake, Spooner, Trego
Miller Trunk	Caribou Lake, Hermantown, Pike Lake, Saginaw
North Shore	Lakewood, Lester Park, Northshore, Ordean Middle, Rockridge, St. Michael's
Pine	Askov, Finlayson, Hinckley, Kerrick, Sandstone
Proctor	Bayview Heights, Munger, St. Rose
Sand Hills	Bennett, Gordon, Minong, Solon Springs
South Shore	Brule, Herbster, Iron River, Lake Nebagamon, Maple, Oulu, Poplar, Port Wing, Elizabeth
South Superior	Bryant, Central Junior, Four Corners
Spirit Valley	Macarthur, Morgan Park, St. James, Stowe, Raleigh Edison
Trail's End	Cable, Drummond, Hayward, Radisson, Stone Lake, Winter
Trefoil	Chester Park, Congdon, Holy Rosary, Woodland Middle
West Superior	Blaine, Cathedral, Cooper, Pattison, Maranatha Academy
Whispering Pines	Alborn, Carlton, Cloquet, Esko, Wrenshall
Woodland	Homecroft, St. John's

was just listed by the town name. For these twenty-three schools, Map Quest©

was used to locate the school and then that information was used to locate the school on the roads layer in the appropriate school district using ArcView. The school with just a town name for its address is located on Madeline Island and thus easy to locate.

Once all the schools were located and mapped, the service unit boundaries were drawn, matching school district boundaries and including all the listed towns for that service unit (Figure 3). In some areas such as Cook County, Minnesota, the entire county was the same as the school district. Where school districts crossed county lines, the location of the schools or towns helped to define the service unit boundaries.
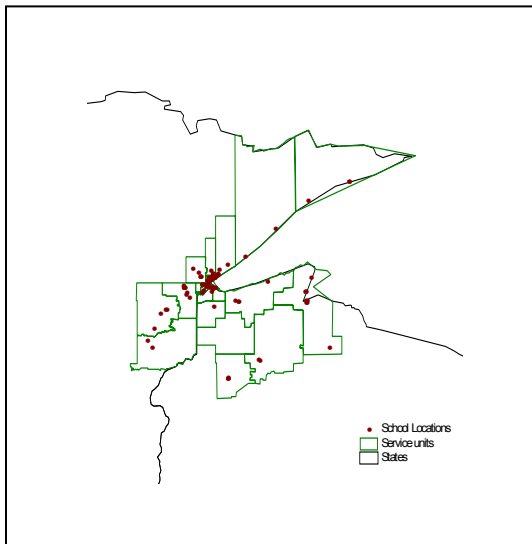

Figure 3. GSNPC Service Units with schools

An example of the data is shown in table 2. "G" represents the number of girls enrolled in that level of scouting while "E" represents the total number of girls enrolled in the associated grade levels.

Table 2. Example of GSNPC data for 1995.

Service Unit		Daisy	Brownie	Junior
Agate	G	21	88	57
	E	85	221	272
Whispering Pine	G	30	131	81
	E	229	596	628

The tabular data was entered into an Excel spreadsheet for each year and service unit. To join the data table to the service unit boundaries, a location in each service unit was selected as the coordinate for that service unit. This allowed the data to be displayed geographically by service unit and year. Several problems with the data were discovered at this point. Some service units had values both for total enrollment and Girl Scout enrollment that were much smaller for one year when compared to the other year's enrollment data. Some of the errors were due to errors in typing the data, while discussions with the staff at GSNPC clarified the other data errors. In some cases, the error was due to incorrect data from GSNPC. For the Duluth Secondary Service Unit, after 1995, there were data for Junior Scouts included with Cadette and Senior Girl Scout data. This was due to the Duluth School District changing from a system of Grade School, Junior High School and Senior High School to one of Grade School, Middle School and Senior High School. This resulted in sixth graders moving from a grade school to a middle school and being counted in the Secondary Service Unit. As it was not possible to determine which of the six Duluth Service Units the data should be included with, the values were evenly distributed across all six service units.

To determine change over time, each year's enrollment in scouting and school grade enrollment were subtracted

from the previous year's enrollment, using 1995 as the base data. Mapping the change from year to year was nice but did not yield the full picture. Each year's total enrollment was queried for those service units that had an increase or decrease in total enrollment. The resulting data was then queried as to the change in Girl Scout enrollment for that year. Changes were then mapped and compared year by year for each service unit.

The zip code boundaries were selected two ways. First, using the individual service unit boundaries, the zip code layer was clipped using the GeoProcessing Wizard in ArcView. The resulting areas were merged together to create a zip code layer for GSNPC. Second, a table with the number of girls by zip code for 2000 was provided by GSNPC. This was joined to the GSNPC zip code layer. This allowed the number of girls by zip code to be displayed and compared to each individual service unit.

Given five years of data for twenty-one service units for five levels of scouting, only the information for Junior Scouts is presented here in detail. Similar analyses have been completed for the other levels of scouting for the GSNPC.

Results and Discussion

Starting by determining the percent of girls in any given Scouting level in relation to the total number of girls in that grade grouping, each year was mapped to see if any trends appeared. The large number of service units made it difficult to identify any trends.

Reviewing at the five-year average provided some information.
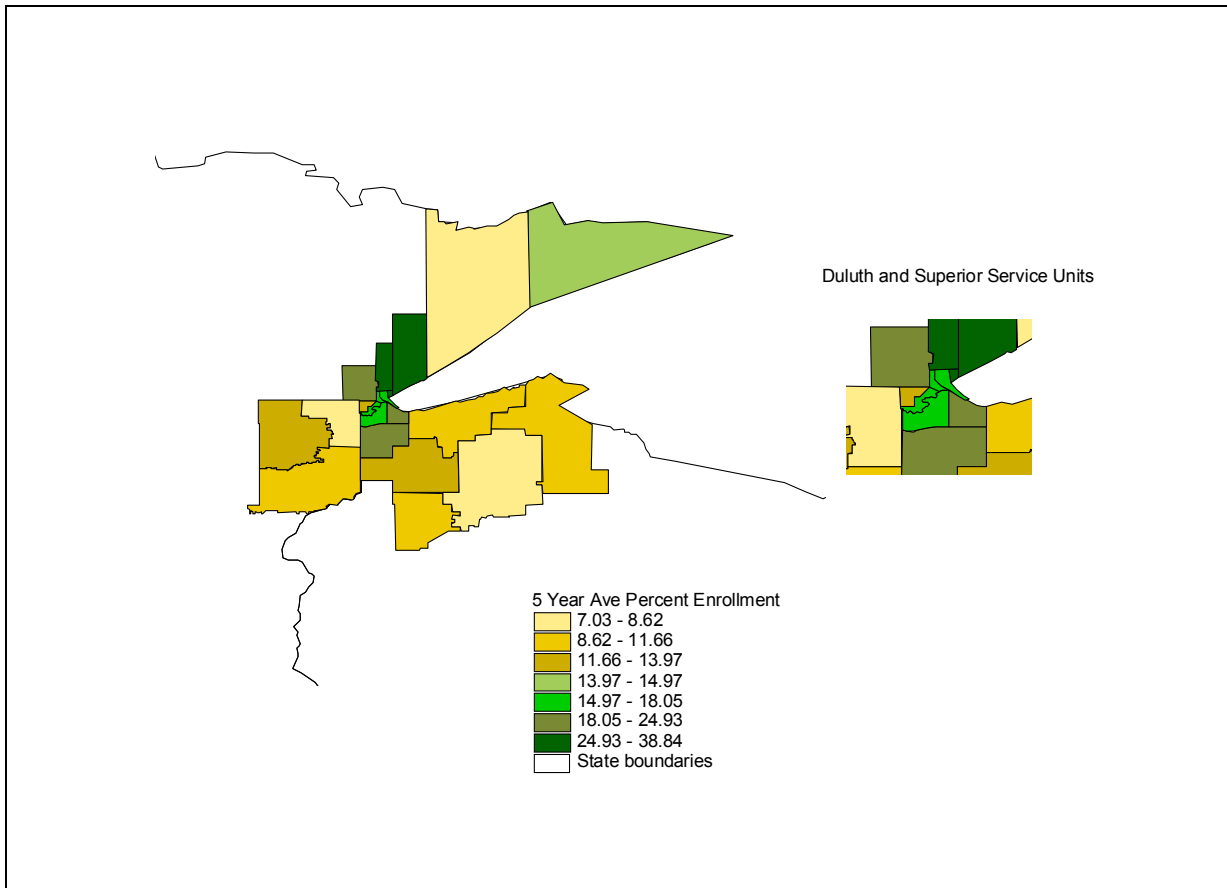

Figure 4. Five-year average percentage of girls enrolled as Girl Scouts in GSNPC

The range in percent of girls enrolled in any level of scouting for the five years ranged from a low of 7.03 percent for Trails End to a high of 41.79 percent in North Shore, with an average of 17.9 percent (Figure 4). The national participation rate is 11 percent. Over five years (1995 – 1999) the GSNPC had greater participation in Scouting than the nation as a whole.

Over five years, there were an average 47.74 girls per year enrolled as Junior Scouts per service unit or 18.35 % of the girls in grades 4 to 6 joined Girls Scouts (Figure 5). The service unit the highest Junior Scout enrollment varied from year to year. Trefoil Service Unit had the highest percent of enrollment in 1995 (40.32), 1997 (33.33) and in 1998 (36.78). North Shore Service Unit was

highest in 1996 (32.67 %) and South Superior Service Unit was highest in 1999 (38.67%). The lowest percentage of enrollment was even more varied. In 1995, both Harbor Bay and Trail's End Service Units had 6.9 percent of all the girls in grades 4 to 6 enrolled as Junior Scouts. Trail's End Service Unit was also lowest in 1999 (7.43). In 1996, South Shore Service Unit had the lowest percent enrolled (5.32%) while Chequemegon Service Unit has the lowest in 1997 (8.22%) and Pine Service Unit had the lowest in 1998 (10.15%).

The Service Units with the highest enrollment are located in Duluth or Superior or are adjacent to these cities. Those Service Units with lower enrollments are located farther from these cities and tend to have dispersed
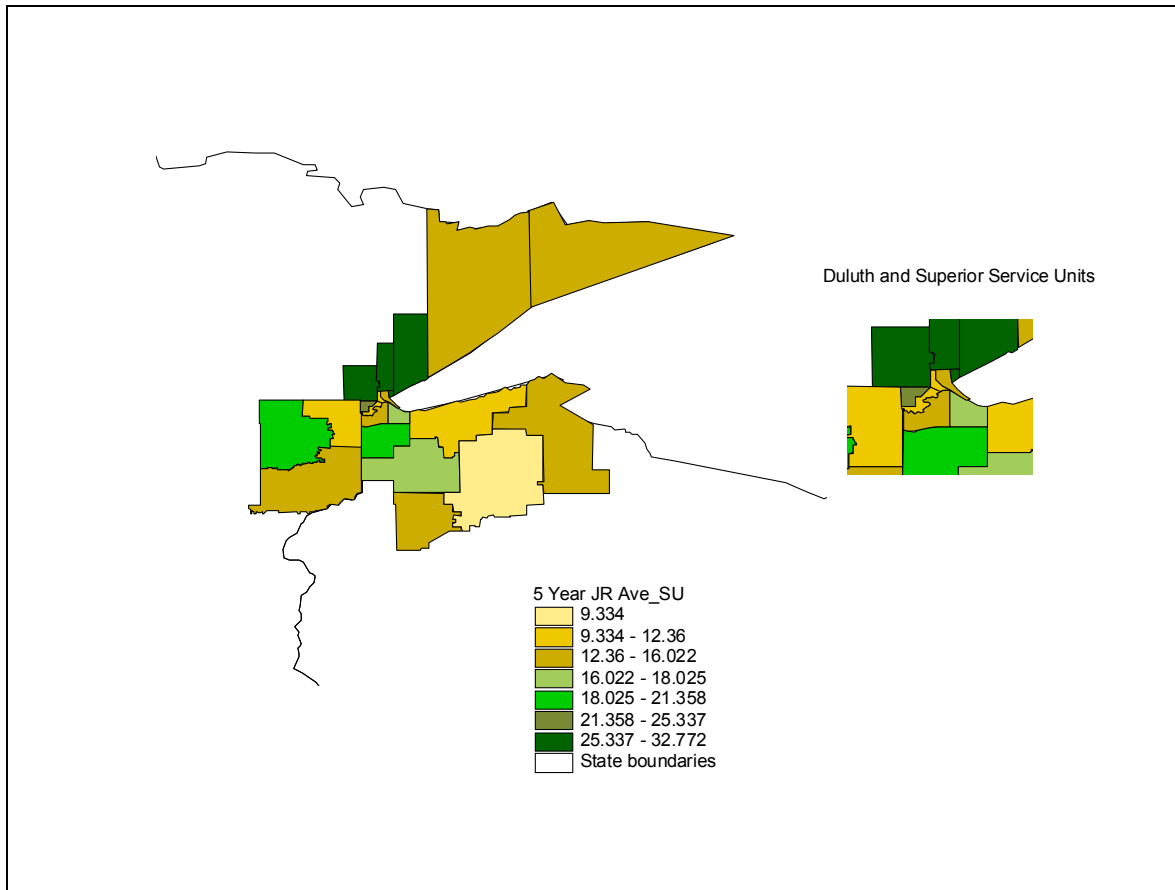

Figure 5. Five-year average Junior Girl Scout enrollment, GSNPC

populations. This may be a factor in the lower percentages of girls enrolled as Junior Scouts away from Duluth or Superior.

While averages, highs, and lows provide a general picture for the Council, the question of what happened each year to each service unit was the bigger question. Using 1995 as a base, the change in the number of girls enrolled as Junior Scouts was determined for each year by subtracting each year's enrollment from the previous year's enrollment. Changes in enrollment may be due to one of the following: 1) Change in the number of girls enrolled in grades 4 to 6; 2) Girls moving up into seventh grade; 3) Girls moving up from third grade; or 4) Girls dropping out of scouting.

With the data used in this study, it is not possible to track each individual girl to determine if she remained in scouting or not. It is possible to obtain a general idea of how the total number of girls in grades 4 to 6 changed. This change may be due to one of the following: 1) Girls graduating to seven grade; 2) Moving out of the Council area; 3) Girls moving up to fourth grade; or 4) Changes by the school districts. Between 1995 and 1996, the Duluth School District changed the grade structure of the schools. In 1995, grades 4 to 6 were in the same school but in 1996, grade 6 had been relocated to the Junior High Schools. This dropped the enrollment in the grade schools in North Shore, Woodland, Trefoil, Heritage Heights, and Spirit Valley service units from 1995 to 1996. Hill and Dale service unit showed a slight increase in the number of girls in the grades in question. For four of the six service units, there was a corresponding reduction in Junior Scout enrollments.

When reviewing the changes between 1996 and 1997, there was not a district change to account for any decrease in girls enrolled in grades 4 to 6 (Figure 6).

Yet fifteen service units had decrease in enrollment in grades 4 to 6. Of these fifteen, eight also had reductions in girls enrolled as Junior Scouts. Of the six service units that had increases in enrollment in grades 4 to 6, three also had increases in the number of Junior Scouts. Between 1997 and 1998, ten service units experienced decreases in the number of girls in grades 4 to 6. This time, eight service units also increased the number of Junior Scouts. Of the eleven that had increased enrollment in grades 4 to 6, five service units had decreased Junior enrollment and six had increased. The change between 1998 and 1999 saw eleven service units with decreased enrollment and ten with increased enrollment in grades 4 to 6. Seven service units with fewer girls in grades 4 to 6 also had fewer girls as Junior Scouts and seven service units with increased enrollment also had increased numbers of Junior Scouts.

Each service unit varied from year to year in the number of girls enrolled in grades 4 to 6 as well as the number of girls in Junior Scouting. Three groups of changes occurred in the service units. The first group are those service units that had at least two years where the number of girls in Junior Scouting increased even though the total enrollment decreased. Of these seven service units, two had three years with this trend and the remaining five had two years. In seven other service units, the number of girls enrolled in Junior Scouting decreased as did the total
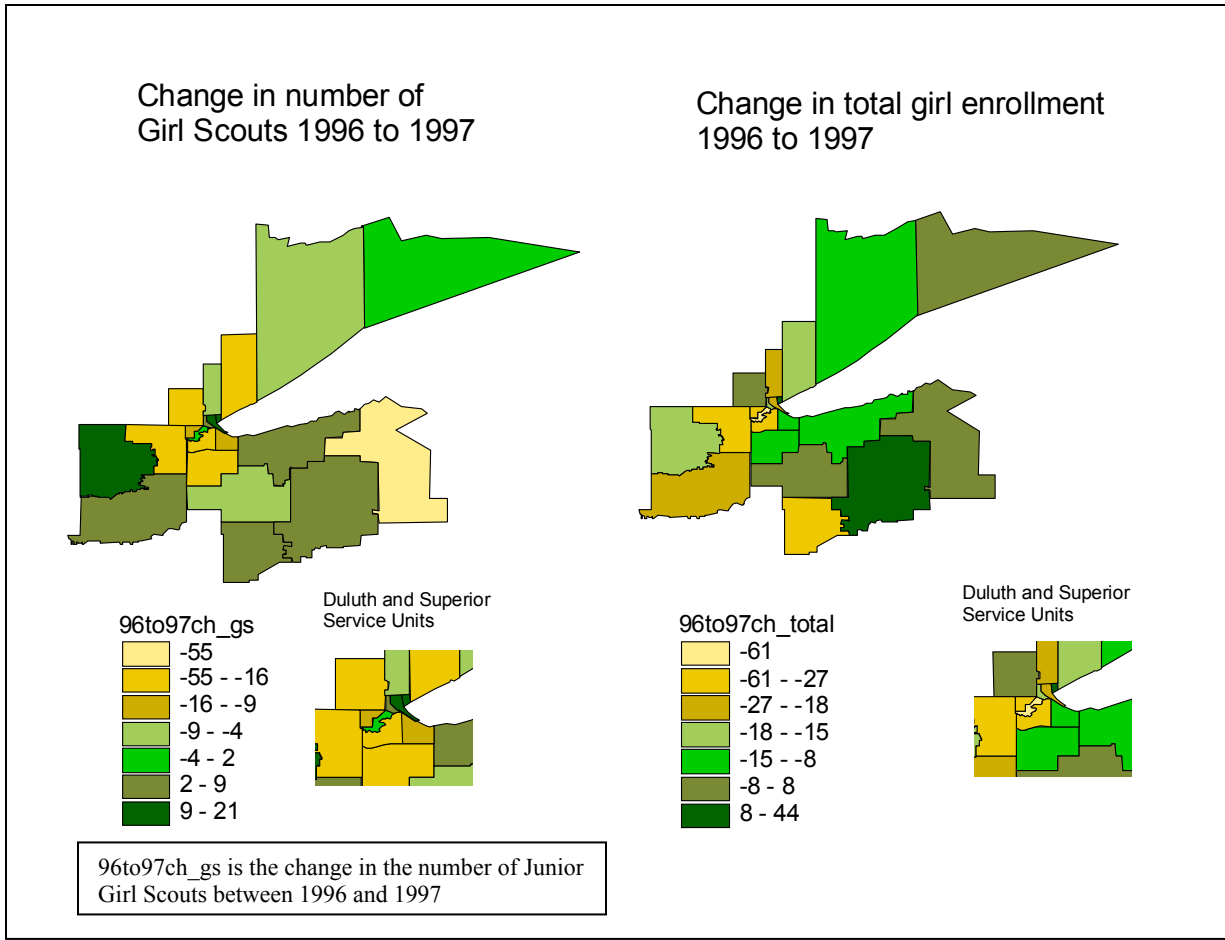
Change in number of
Girl Scouts 1996 to 1997

Change in total girl enrollment
1996 to 1997

Duluth and Superior
Service Units

96to97ch_gs
- -55
- -55 - -16
- -16 - -9
- -9 - -4
- -4 - 2
- 2 - 9
- 9 - 21

96to97ch_total
- -61
- -61 - -27
- -27 - -18
- -18 - -15
- -15 - -8
- -8 - 8
- 8 - 44

Duluth and Superior
Service Units

96to97ch_gs is the change in the number of Junior
Girl Scouts between 1996 and 1997

Figure 6. Change in total enrollment and number of Junior Girl Scouts, 1996 to 1997, GSNPC

number of girls in grades 4 to 6. In this group, the split was three with three years and four with two years. Of the remaining seven service units, one had two years when girls in Junior Scouting decreased while total enrollment in grades 4 to 6 increased. Three service units enrolled more girls in Junior Scouting as the total enrollment increased. Finally, three service units had no pattern. The number of girls in Junior Scouting increased and decreased as did the total enrollment without any pattern.

Statistical Analysis

Correlation analysis were conducted between the number of girls enrolled as Junior Scouts and the number of girls in grades 4 through 6. This correlation was conducted for each year for the five year period of the study (1995 to 1999). In each case the correlation was highly significant ($p<0.01$). This analysis indicates that a strong predictive relationship exists between the number of girls in scouting and the population of students in grades 4 through 6. Generally speaking, one can expect the number of girls in scouting to increase as the number of girls increases.

Combining the number of girls in Junior Scouting and the number of girls in grades 4 through 6 for the five years

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of the study yields a correlation value of 0.649 (p<0.01). Regression analysis of these data results in the following predictive model:

Girls in scouting = 17.26 * .111(number of girls in grades 4 to 6)

Thus the number of girls in scouting may be roughly estimated by the aforementioned equation. For instance, if there are 100 girls in grades 4 to 6, then this equation would suggests the likelihood of approximately 18 girls becoming Junior Scouts.

Variations from this predicted number can be expected due to random chance and unexplained variation but it does give an estimate of the number of girl to expect in scouting for a service unit and a benchmark to estimate whether actual participation is below, at, or above average.

Zip Codes

The zip code boundaries used in this study were obtained from the Bureau of Census Tiger Files. This data is not the same as the zip codes used by the US Postal Service. In fact, "ZIP Codes are not required to be a polygon making them difficult to map. They are networks of streets served by mail carriers or just individual post offices and are a tool for mail delivery. They also change periodically as required to meet Post Office operational needs" (Census Bureau 2002). The Census Bureau developed the ZIP Code Tabulation Areas (ZCTAs ™) in conjunction with the 2000 Census to address the difficulty of precisely defining each ZIP Code® area. ZCTAs™ are "generalized area representations of U.S. Postal Service

ZIP Code service areas…they represent the majority USPS five-digit ZIP Code found in a given area" (Census Bureau 2002). ZCTAs™ follow census block boundaries and the actual code assigned to a ZCTA represents the majority of Zip Codes in that block, including in all water bodies. In some instances, a ZCTA has three digits followed by XX. These are large land areas, generally larger than 25 square miles, where there is insufficient information to determine the five-digit ZIP Code and are generally rural areas with little settlement (Census Bureau 2002). In Minnesota, the XX was used in parts of the Superior National Forest and in State Forests (figure 7). There are 112 ZCTAs within the GSNPC area, including the bodies of water and those ZCTAs that ended in XX. Eliminating the five HH ZCTAs and the four XX ZCTAs leaves 103 ZCTAs in the GSNPC area.
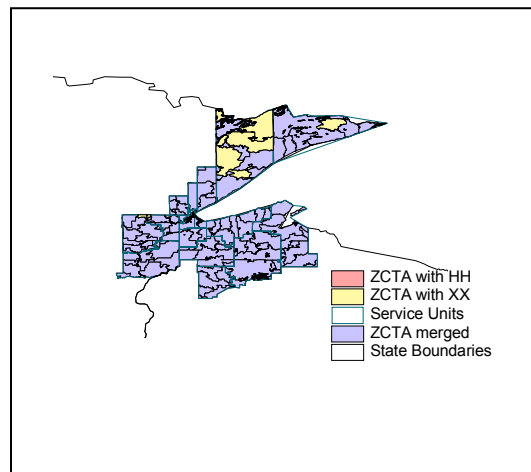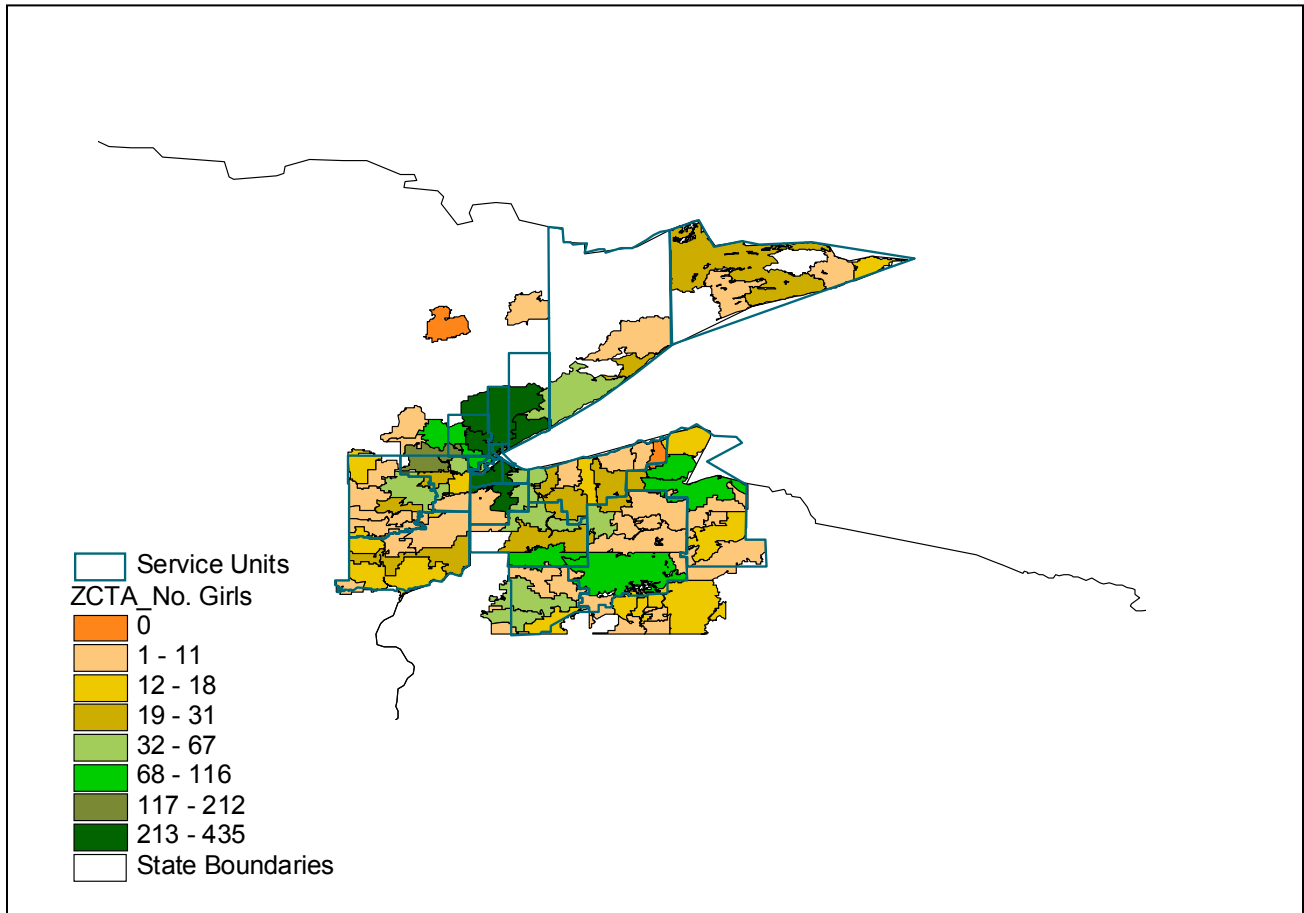

Figure 7. ZCTA in GSNPC Service Units

Based on the above information, it is not possible to correlate service unit boundaries with US Postal Service Zip Codes with which the GSNPC is most familiar. It is possible to relate the ZCTAs™ with service units and this should help the GSNPC narrow the

Figure 8. Number of Girl Scouts by ZCTA, 2000, GSNPC

the location of each national GS map. As shown in figure 8, there are ZCTAs™ that fall outside of the boundaries of the GSNPC. This is possible due to girls attending schools in the GSNPC but living outside of the GSNPC boundaries or errors in creating the service unit boundaries. The white areas are either areas of water (ZTCA of HH), areas of little settlement (ZCTA of XX), or areas that the National Girl Scout office does not show girls registered in scouting in the GSNPC. A ZCTA with zero girls registered in 2000 had a girl registered in the previous year but not in 2001.

Conclusions

help the GSNPC identify where approximate zip code boundaries are located. Relating those boundaries to service units is also possible but the difficulty arises when trying to relate USPS Zip Code areas to Census Bureau data. The National Girl Scout Office needs to provide a better explanation to local Girl Scout councils of the data they are using and help prevent or reduce confusion about zip codes.

Looking at change over time was harder in part because so many factors play a role in the change that occurred. Change may be due to girls not continuing in scouting, moving out of the council area or it may be a reflection of the local troop leader or Council staff. This paper did not focus on the

economic factors that may influence a girl's family moving out of the Council nor was it able to follow any girl through out her time as a Girl Scout. General trends were identified but it will be up to the Council to see if there is a reason for the change that may be addressed by training or encouragement to girls to remain as a Girl Scout.

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