

Integrating Social Survey Data and GIS to Determine the Needs of a Rural Community in a Geographic Context

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By James M. McCluskey

Dr. McCluskey is a professor in the Department of Geography and Geology with the University of Wisconsin Colleges. He can be reached at jim.mccluskey@uw.edu.

Overview

The Town of Wausau, Wisconsin, is a rural community in Central Wisconsin with a population of 2,229 (Census 2010). The geographic extent of the town is 37.7 square miles. The political boundary of the town coincides with one surveyed township of the U.S. Public Land Survey System (PLSS) and is subdivided into thirty-six surveyed sections, each with an area of approximately one square mile. The western boundary of the town is irregular due to annexations by the neighboring City of Wausau (population 39,106, Census 2010) (Figure 1).

The Wausau Town Board wished to gain an insight of the level of government services desired by its citizens in relationship to the taxes which they were willing to pay for the services during a time of economic downturn and limited government funding. To this end, it was decided that a survey of the town's residents needed to be conducted. The survey addressed several issues, including the need for specific services, the willingness of community members to pay specific services, and other key issues important to the community.

The Town Board contracted with the Wisconsin Institute of Public Policy and Service (WIPPS) in October 2010 to formulate survey questions, compile results, incorporate the survey results within a GIS, and complete a final report. WIPPS is a unit within the University of Wisconsin Colleges and the University of Wisconsin Extension and is a nonpartisan, nonprofit organization tasked with providing meaningful public outreach to the people of Wisconsin. The town realized a significant savings by partnering with WIPPS to complete the project.

Problem

The Town of Wausau has a population density of 59 persons per square mile. Examination of the Town of Wausau's 2006 comprehensive plan indicates that various agricultural pursuits are the leading land use in town at 48.5%. Woodlands and wetlands account for 25.8% and 13.4% respectively of the total land area of the town. There is little commercial development, with only 0.4% of the land area devoted to commercial pursuits. Residential development accounts for 6.8% of the land use in the community and is greatest in the western third of the town that borders on the City of Wausau. Population growth has been slow over the last forty years with a population change of 141 persons (6.2%) between the 1970 and 2010 censuses.

One of the major problems in conducting social surveys in rural areas, like the Town of Wausau, is the need to protect the anonymity of the respondents. The problem is enhanced when the

information is incorporated into a GIS and portrayed as mapped data. The potential exists in rural communities with low population densities for community members to identify responses provided by individual households. Concern about this issue was expressed by several members of the community and was a major discussion point between the Town Board and WIPPS in the formulation of the survey and design and of the GIS. The problem was how to present the survey results in a mapped context without compromising the anonymity of the respondents.

Solution

The solution to of the problem was solved by using surveyed PLSS sections of the township as a map grid by which the results of survey questions were reported (Figure 2). The responses to the survey questions were broken down by surveyed section using the MYSTAT (Version 12) statistical software package and mapped using Caliper's Maptitude (Version 5) GIS . The use of surveyed sections is used on a regular basis as the mapping unit for various geological, biological, and agricultural studies, but not for mapping the results of data collected from social surveys.

Surveys were sent to all households in the town in October 2010. The residential database of the town was the source of the addresses. Slightly more than 900 surveys were mailed and 505 households returned completed surveys, representing a return rate of 56 percent (Figure 3). The survey required approximately ten minutes to complete. All survey responses were anonymous. The first question on the survey asked the respondents to identify the section of the township in which they lived. A map was provided for reference purposes. Several background questions were asked of respondents which pertained to the socioeconomic characteristics of the household, including median age, level of educational attainment, and household income. Specific questions related to key issues facing the town used a modified Likert scale to gather responses to determine the strength of agreement or disagreement of each of the questions. The results of the survey had a 95 percent confidence level with an error range of plus or minus 3 percent.

Results

The Town of Wausau is an older, middle class community with a median age of the population between 45 and 54 years and a median income of between \$50,000 and \$74,999. Most of the respondents are high school graduates with some college. The average resident has lived in the community between 11 to 20 years and 95% of the residents owned their own homes.

Several survey questions were designed to gather information about the public services which residents wanted and their willingness to pay of these services. These public services included: fire service, ambulance service, snow plowing and sanding, road maintenance, garbage and recycling pickup, asphalt roads, town constable and police, town ordinance enforcement, update and upgrade of equipment, and building upgrades and remodeling. The level of the importance of each service to the town's residents and their willingness to pay for each service were each ranked according the number of responses received. A Spearman ranked correlation coefficient (non-parametric test for ranked statistical data) was calculated to test for the level of agreement between the residents expressed need for specific public services and their willingness to pay

for them. The calculated Spearman correlation coefficient was $r = 0.983$ at a 95% confidence level. The results of the statistical analysis revealed an almost perfect correlation between the public services wanted by the residents and their willingness to pay for them.

Many key issues facing the town were also addressed by the survey. Questions pertaining to these issues used a modified Likert scale to gather responses. To each of the questions, residents could express their level of agreement or disagreement. Use of the Likert scale facilitated the mapping of the response data. Proportional pie charts were used to summarize the results for each question by surveyed section. One key issue facing the town is its future development. The question, "Do you think the Town of Wausau needs more commercial development such as offices, retail stores, or service business?" was asked to explore the residents' opinions on future commercial development. The majority of residents responded that the situation was fine as is (Figure 4). Another key issue of concern to the town is the aesthetics of the community. The opinion on this issue was about equal for and against as seen in the responses to the question, "The Town of Wausau should create and enforce ordinances to ensure appearance standards for lawns, yards, and home property generally?" (Figure 5).

Other issues addressed by the survey pertained to safety issues facing the community such as the use of geographic restrictions of the use of firearms during deer hunting season, especially in more populated areas of the town. Figure 6 shows that most residents feel that there should be no hunting allowed in residential areas, along subdivision borders, or along the city border. A minority of the respondents felt that hunting should not be restricted to hunting on private land. The presence of certain dog breeds within the town limits is also a concern of the community because of the potential for attacks on the residents. Most residents felt that there should be no restrictions to different dog breeds in the community in response to the question, "Should certain dog breeds be banned from the town of Wausau?" (Figure 7).

Conclusions

The use of surveyed sections of the PLSS as the mapping unit to present data collected from rural areas is a straightforward method to portray information in a geographic context. In the United States, access to digital geographic files for the PLSS is universal and easily incorporated into a GIS. The method allows for the preservation of the anonymity of respondents and yet allows for the visual presentation of information to decision makers. This project also demonstrates that programs affiliated with state universities, like WIPPS, through their community outreach efforts can provide rural communities the expertise and resources needed to complete complex projects in a timely manner with a significant cost savings.

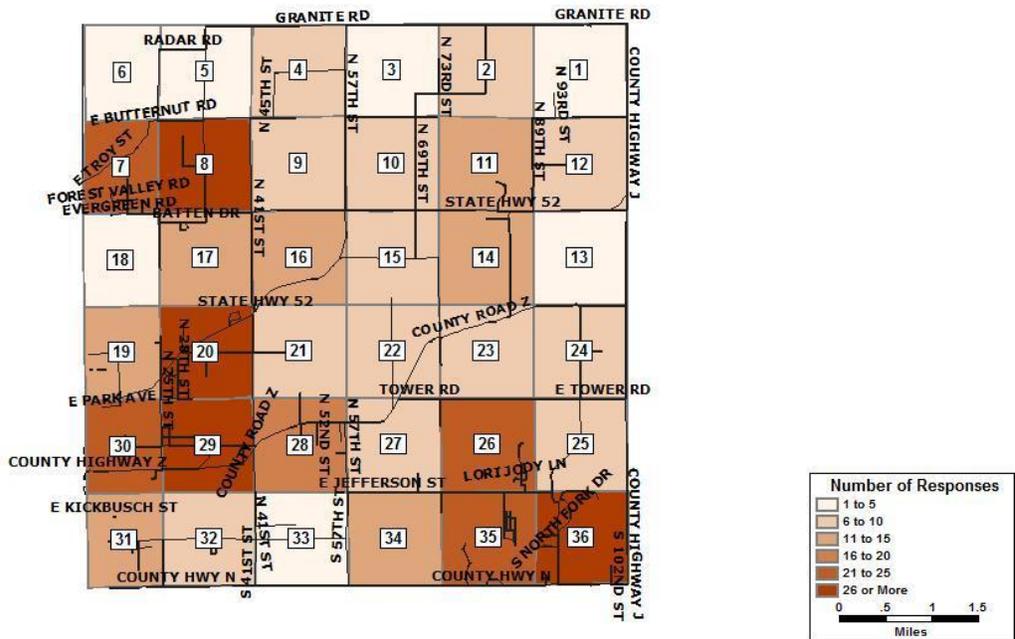


Figure 3. Number of respondents by PLSS survey section.

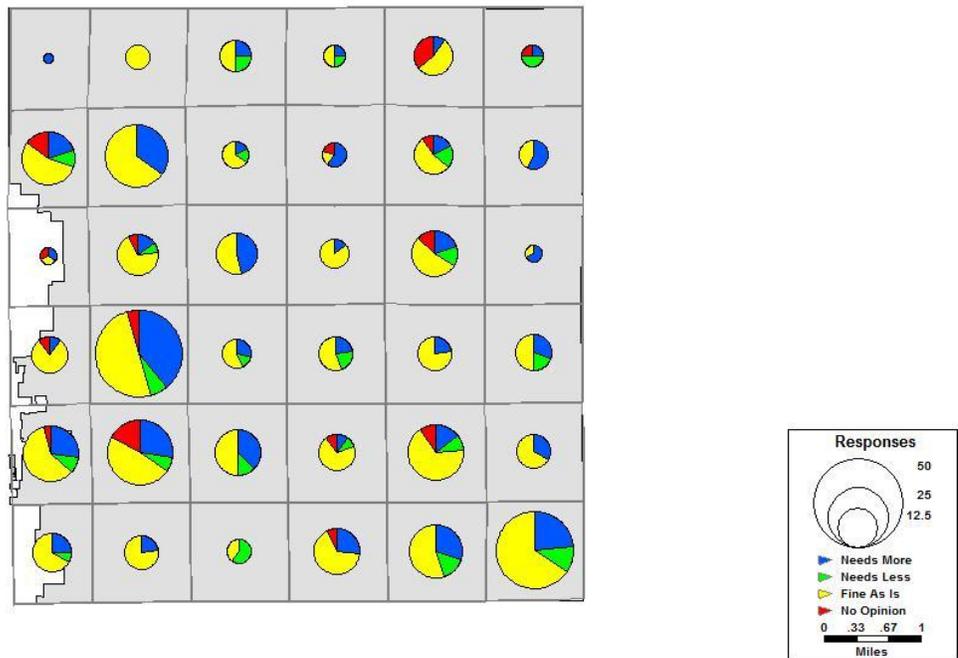


Figure 4. Number of respondents by survey section on key issue regarding the future commercial growth.

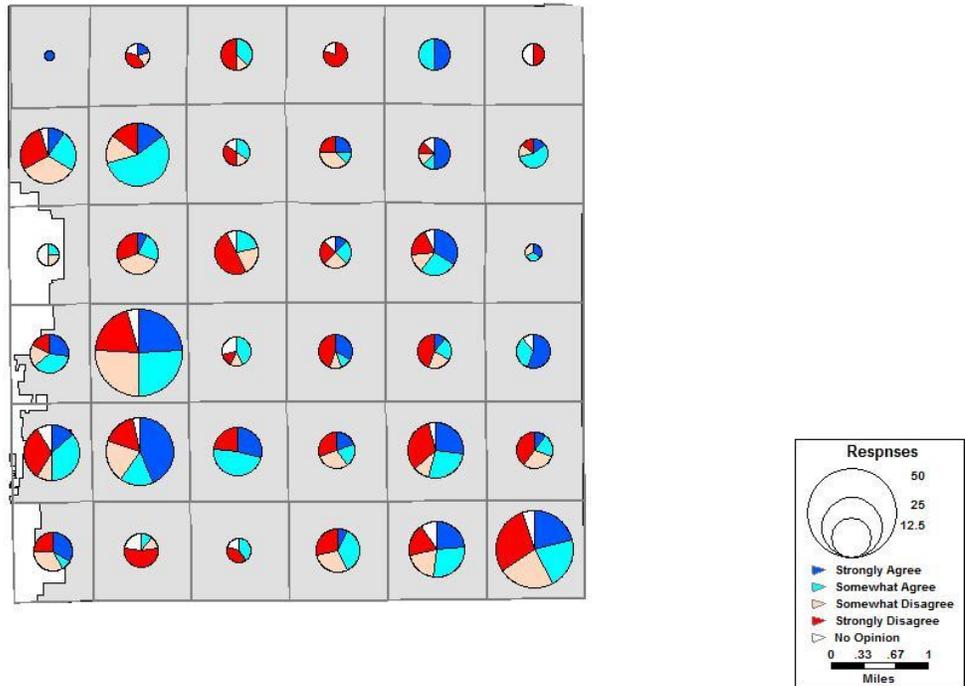


Figure 5. Number of respondents by survey section on key issue of the enforcement of aesthetic standards in the community.

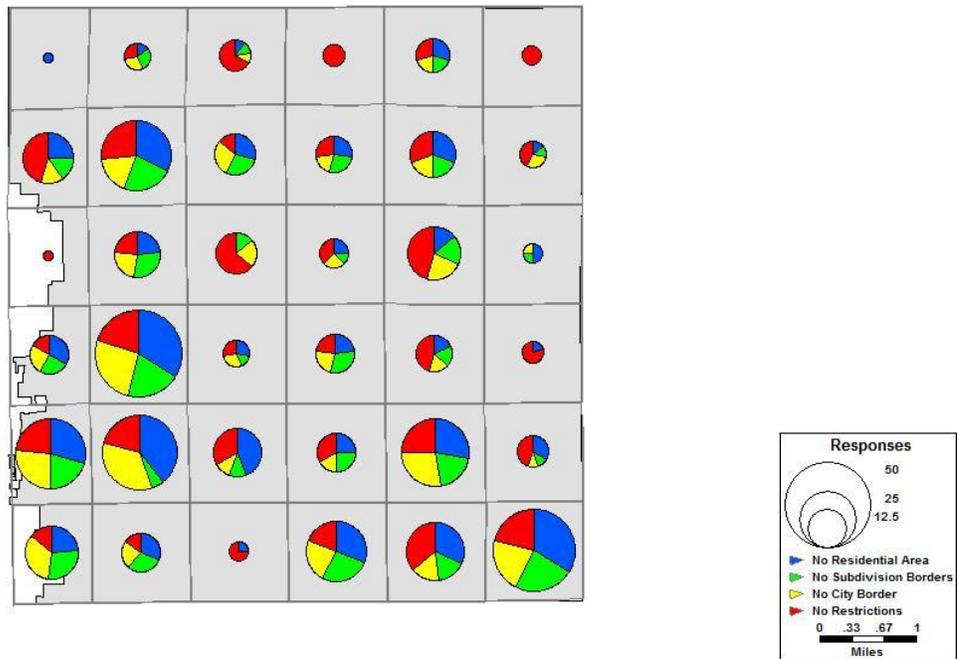


Figure 6. Number of respondents by survey section on the key issue of rifle hunting in the town limits.

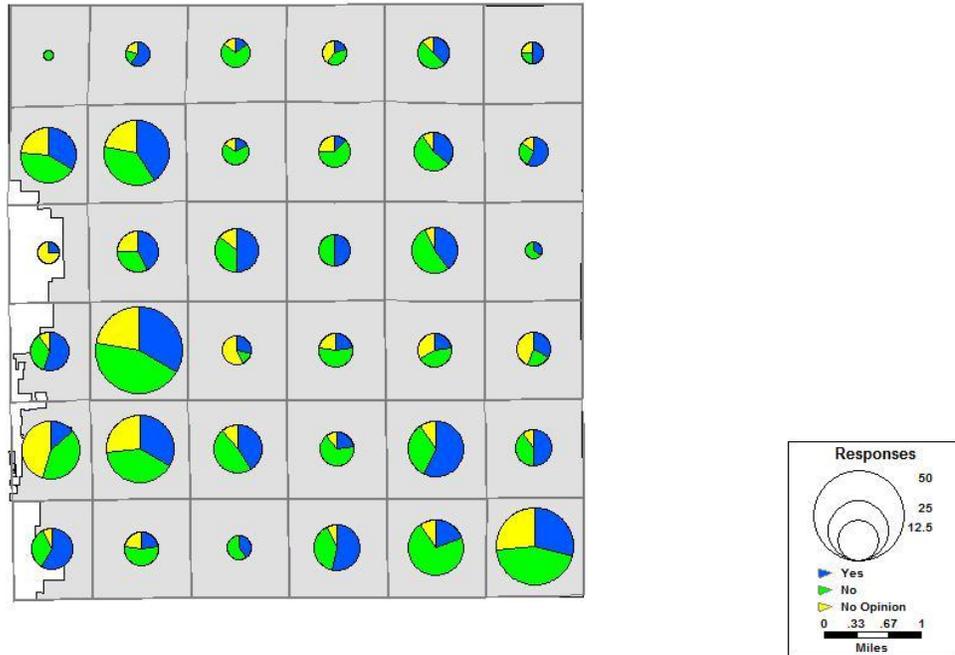


Figure 7. Number of respondent by survey section on key issues of banning certain dog breeds within town limits.