

# Developing a COLLABORATIVE GIS Project in SOCIAL SERVICES

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Since President Clinton signed the welfare reform law to “end welfare as we know it” in 1996, many states have started to search for innovative ways to help welfare recipients become economically self-sufficient. Collaborative partnerships and research has become one of the innovative approaches for addressing welfare issues and helping people in need. Collaboration between social work, health care, and education is reported to promote health and to increase the effectiveness of social work intervention programs (Bogo and others, 1992; Lopez and others, 1998).

In November 1997 the Maryland Department of Human Resources (Baltimore), through the Office of Adult and Family Services of the Community Services Administration, solicited grant proposals for the family investment program, which emphasized community partnerships between local departments of social services and other agencies. The Wicomico County Department of Social Services and the Department of Geography’s GIS Mapping Science Group at Salisbury State University (Salisbury, Maryland) were awarded a \$40,000 grant to collaborate on a social service GIS project in June of 1998. Maryland DHR funded this one-year collabora-

tive effort with matching funds from WCDSS. The primary objective was to map the spatial distribution of temporary cash assistance clients, abused and neglected children, and support services to enhance social-service access and delivery. This effort was also aimed at improving the WCDSS decision-making process in planning and allocating community resources for expediting clients’ entry into the workforce.

## Design and database development

An operational GIS required several fundamental components to be in place: hardware, software, databases, and human resources. In this collaborative effort, project design was accomplished by sharing resources, expertise, ideas, expectations, and GIS implementation methodology. Maryland DHR provided partial funding and political support. WCDSS provided firsthand experience and knowledge, social service data, and most importantly, descriptions of needs and expectations. GMSG members at Salisbury State University provided GIS expertise and implemented the project.

ArcView and ARC/INFO GIS (ESRI, Redlands, California) software running on Pentium personal computer stations, with 300 megahertz, six gigabyte harddrives, and 64 megabytes RAM, make up the project’s system architecture; components are located in SSU’s Geography Research Lab. The database was developed by collecting, converting, and transferring data from multiple sources. Some of the data layers were input from hard-copy text files, some were manually edited to add additional in-

formation, and some were converted into a format compatible with ArcView. Based on the objectives of the project, four data layers were identified and included in the database:

**Wicomico TCA clients and AAN children data.** As of October 1, 1998, there were 1,189 TCA cases and 285 AAN children cases. Coauthor Robert Drudge of WCDSS created the database in Microsoft Access. TCA data included 30 attribute descriptors of TCA clients, such as date of birth, race, age, education, dates on and off welfare, number of children, and so on. GMSG edited, converted, and imported these data into the ArcView system at its research lab.

**Wicomico Street map.** This map layer was developed from the 1995 Topologically Integrated Geographic Encoding Referencing (TIGER)/LINE boundary file, which was in a State Plane projection and NAD 27 datum. Only 22 percent of the street segments were coded, but at that time it was among the best of the commercially available maps. The key attribute fields of a road segment include its name, prefix, length, and address ranges for both sides of the road.

**Maryland Property View data.** This digital database, purchased from the Maryland Office of Planning (Baltimore), contains records and locations of the entire Wicomico County properties, and image data as background information.

**Other data.** Additional data were incorporated into the database, including 1990 Census block group data, Wicomico licensed day care providers, TCA employers, administrative county boundaries, and mu-

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ADDRESS	CITY	NAME	DOB	Gender	Education
103 Spruce Street	Salisbury	Jodi Brown	5/20/92	F	5
2 W. Pine Street	Salisbury	Miles Long	8/25/62	M	11
2987B Connelly Mill Rd	Delmar	Isabella Mason	12/21/29	F	10
31231 Dagsboro Rd	Delmar	Linda Rawles	12/7/47	F	2
321 Wicotank Road	Fruitland	Jane Doe	4/20/69	F	9
31851 Downing Rd.	Fruitland	Solly Brewing	9/21/46	F	GED
621 River Road	Pittsville	Joe Blow	4/27/73	M	7
5 E. Chestnut Street	Hebron	Couch Pratt	2/26/52	M	11
402 E. Chestnut St	Sharptown	Sarah Jones	3/23/78	F	12



Geocoding

**FIGURE 1** Geocoding maps the client record to the street layer by linking the address field of the two databases. Maryland Property View data were used to help code the street address range. Properties along the Wicotank Road are shown in gold dots, TCA clients in red.

municipal boundaries of major cities and towns.

### GIS mapping and analysis

Once the database was built, GMSG used GIS to map, query, and analyze the spatial patterns of the TCA and AAN data. Unlike traditional pin mapping, GIS mapping in this project was accomplished through an automatic geocoding process in which clients were mapped by linking clients' addresses to a digital street map (see Figure 1). Correct geocoding required a street layer that was completely coded with road names and address ranges as well as error-free client records. As mentioned, only 22 percent of the road segments were initially coded and many roads or segments were missing, especially ancillary roads to mobile home parks.

To geocode all the clients, we needed to further code the street map by using the Maryland Property View data, image data, ground truthing, as well as the Wicomico 911 comprehensive road list. The Property View data, shown in orange, provided a visual reference for address ranges of each road segment; the image data were useful in coding missing roads; and the

county 911 road listing was used for checking road names and overall address ranges.

Although the input of street addresses into the street map database was very time consuming, the effort was worthwhile because the only locational information on

The map of the data shows that significant spatial inequalities exist in client's social environments.

clients is their address. WCDSS is required to keep records of client addresses. Therefore, updating and adding to this database is simply a matter of rematching address information.

Mapping processes helped social service practitioners from WCDSS and policy-makers from Maryland DHR and WCDSS to visualize the spatial patterns related to the characteristics of TCA clients and AAN children (see Figure 2). An analysis of the TCA clients shows that 72 percent are African Americans, 27 percent Caucasians; 91 percent of them are females; their average age is about 31 years old, but a majority of them are 22 years

old; most have an average 11th grade education and two or three children.

Statistics are important, but limited in their explanatory power. The map of the data shows that significant spatial inequalities exist in clients' social environments. Spatially, Figure 2 shows that the TCA clients are highly clustered in certain areas of the county. The social ecological context in influencing welfare and child abuse should be taken into consideration in developing preventive strategies and programs (Mulroy, 1997; Garbarino and Kostelny, 1992; Bronfenbrenner, 1986). Therefore, it is important to examine the social service data in the context of overall social environment. To better understand the spatial and socioeconomic environment of the TCA clients, GIS was used in conducting data integration and neighborhood analyses.

The integration analysis of the social service and census block group data revealed that most TCA clients were concentrated in a small number of block groups. These block groups had the lowest mean property values in the county, less than \$65,000. Clearly there are a lot of substandard houses in these census blocks. Data on household income revealed that more than 50 percent of the clients live in only 20 of the 74 census block groups. In these 20 block groups, 25–60 percent of the households have incomes less than \$15,000 (see Figure 3).

Another integration analysis was carried out by overlaying TCA clients, childcare, and employer data layers. The mismatch between the clients' needs and available services was also clear. If WCDSS assumes a childcare facility's maximum capacity as 40 children, then 76 percent of the clients are located in the underserved areas where the average number of children per childcare facility range from 41 to 275 (see Figure 3).

Spatial accessibility to the services is also an important issue. WCDSS found that 13 percent of the clients live more than one mile from their closest childcare, without even considering the availability of these facilities in terms of children's age and operation hours. (This information is incomplete in the database at this time.) As for employment opportunities, most TCA employers are located in the Salisbury metropolitan corridor along U.S. Route 50 and Route 13. The analysis indicated that 25 percent of the clients live more

## Acronyms

**AAN:** abused and neglected

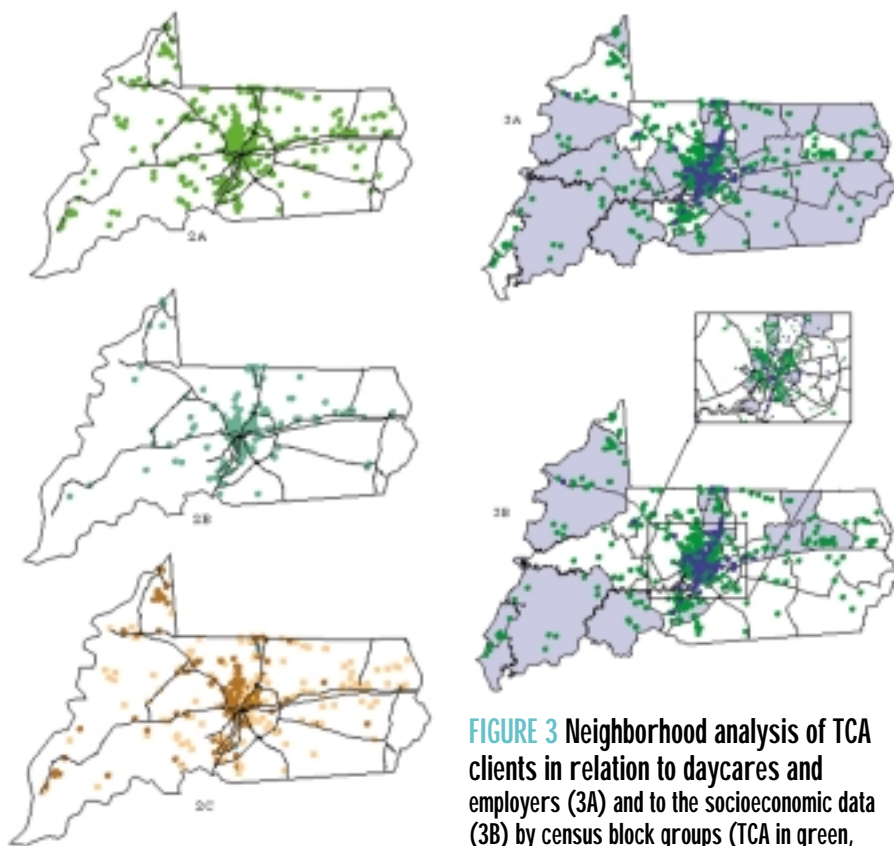
**DHR:** Maryland Department of Human Resources

**GMSG:** GIS Mapping Science Group

**SSU:** Salisbury State University

**TCA:** temporary cash assistance

**WCDSS:** Wicomico County Department of Social Services



**FIGURE 3** Neighborhood analysis of TCA clients in relation to daycares and employers (3A) and to the socioeconomic data (3B) by census block groups (TCA in green, employers in blue)

**FIGURE 2** Distribution of temporary cash assistance clients (2A), abused and neglected children (2B), and TCA race profile (2C; dark brown: African Americans; light brown: Caucasians; light blue: others)

than one mile away from any of the potential employers. The analysis shows that the need for transportation service is obvious.

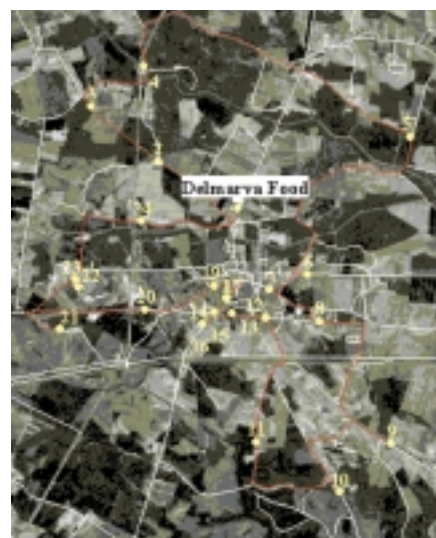
The GIS analyses revealed that TCA clients are not dispersed evenly across the county. Welfare problems are indeed neighborhood-constrained. Community-oriented support (health care, childcare, job training) and transportation services have to be concentrated and enhanced (Schmoke, 1997). For example, GIS can help locate a service site in the underserved areas. Another example of GIS application is to design an efficient travel route for transporting clients from home to work. GMSG also explored the potential use of GIS in planning efficient transportation routes for the under-served areas (see Figure 4). These potential uses of GIS in strategic program planning provide fundamental information for the state and county social service administrators to develop community-based support and inter-

vention programs.

### Knowledge diffusion

The long-term effect of a collaborative project lies in technology transfer and knowledge diffusion. Knowledge transfer has motivated the search for innovative solutions in many social services programs (Martinez-Brawley, 1995). In addition to the GIS mapping and analysis, knowledge diffusion was considered an important aspect of this project.

Knowledge diffusion in the project was a two-way process. Social service professionals learned about GIS and its utilities, and GMSG has gained a better understanding about the needs of social services and has explored new ways of analyzing the data. The dissemination of GIS information was accomplished through a two-level effort: technical training and show-and-tell demonstrations. GMSG offered basic ArcView training to coauthor Robert Drudge and presented numerous demonstrations to the state and county human-social service practitioners and policymakers. This latter level was designed to promote a broader degree of GIS knowledge dissemination to



**FIGURE 4** GIS for transportation planning: an efficient route and ordered stops for transporting 23 clients to potential employer Delmarva Food

social services about the GIS capabilities.

An example of this collaboration was the development of a new TCA database, which expanded and improved on the existing database design. WCDSS provided a set of expectations, which formed a framework for the new TCA database. GMSG made suggestions to WCDSS on the procedures that could be used to reduce or prevent their database errors. As a result, the GIS was developed to meet both the technical and conceptual needs of GMSG and WCDSS. The GIS was tested for its effectiveness by geocoding the newly created TCA database. The accuracy rate of geocoding was improved significantly, from 48 percent for the original TCA database to 92 percent for the new database. This test suggested that the developed GIS project is reliable and can be transferred to WCDSS so eventually they can put it into operation.

### Challenges and solutions

GIS has been widely used in a variety of disciplines, but it remains little used in social services. To develop an operational and effective social service GIS, many obstacles must be overcome in every stage of a project. A particular challenge affecting all social service GIS applications is database quality and compatibility.

In a social service GIS application, database development is the most labor-in-

tensive component. One must consider data sources, data type and format, spatial and time dimensions of data, data transfer and security (client's privacy), data accuracy, and completeness to ensure proper geocoding. Through our project, the project investigators at GMSG found that the following areas encounter common problems in developing a social service GIS application.

The geocoding requires a correctly and completely encoded digital street map. Every relevant road segment should be coded with the street name, street prefix (orientation), and address ranges including from- and to- addresses for both sides of a road. All the intersected roads should have proper topologic relationships. So far, the digital maps that are commercially available are not completely coded and often have missing street segments or are incorrectly coded with the wrong street name, address ranges, or both. To reduce the amount of encoding labor, we concentrated our major effort on the potential welfare "hot spot" areas, instead of coding every single road segment in the entire county.

As for the social service database, most rural areas may not have a digital database. In the process of database development, client information goes through multiple steps and is handled by different people before being input into a computer. Human-induced errors need to be considered and corrected early on. For example, missing attribute fields and typos often occur, including wrong street names or addresses. Moreover, street names change over time, or many towns in a study area may have the same street names. In these situations, additional information such as city boundaries and zip codes need to be input into the database. Most importantly, GIS analysts need to inform social service about the software requirements so potential problems can be alleviated or avoided.

Database development involves collecting and manipulating data from a variety of sources. Data lineage and scales have an important control over data accuracy, completeness, and compatibility with other data. Quality control was emphasized whenever possible during this project. For example, in coding the street map, the GMSG project investigators cross-referenced the information by ground truthing and by contacting local planning offices and local post offices.

### Result and future effort

This collaborative partnership between university and state-county agencies pooled together the resources, knowledge, and technical skills needed for a successful social service GIS implementation. Because of this project, WCDSS no longer needs to manually make pin maps. GIS can produce maps of varied scales yet maintain a constant accuracy. In comparison to traditional pin-mapping, using an array of digital colors and symbols allows us to greatly enhance a map's visual effect. The updating of maps becomes almost effortless as long as the new records are correctly input into the system. The result of GIS mapping and analysis offers valuable information for decisionmakers to plan intervention and support programs, for practitioners to directly help and monitor clients' needs, and for clients to see what resources are available. The collaboration formed a conduit for knowledge and technology transfer, which helped formulate an integrated perspective to the county social service problems.

Although the project was to develop a prototype GIS, its impact has moved beyond accomplishing the short-term objectives. Because welfare problems are geographically constrained, community-based service programs need to be developed or enhanced to help the social

service clients. Job training and transportation service are imperative elements in helping clients off welfare to become economically self-sufficient. This May, Maryland Mass Transit Administration (Baltimore), with an initiative "Access to Jobs/Reverse Commute" funded by the federal government, has awarded a \$100,000 contract grant to the Enterprise Group and the GMSG at SSU to develop a regional master plan for public transportation and a GIS model for routing. We the authors believe that the collaborative effort and GIS technology will make a broader contribution to social services delivery.

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