

HIGHLIGHTS

[GIS 101: What is GPS?](#)

[Department Spotlight: GIS and the Vermillion River Watershed Map](#)

[Desktop GIS: Census Update – What's New in Summary File 1](#)

[Tech Talk: The Geoprocessing Wizard](#)

MEETINGS & EVENTS

October 10 -12

MN GIS/LIS Conference. Duluth, MN. For more details see MN GIS/LIS website:
<http://www.mngislis.org/>

November 14

National GIS Day. For more information check the GIS Day website at <http://www.gisday.com/>

Produced Quarterly by GIS Staff

Randy Knippel
Julie Daugherty
Mary Hagerman
Scott Laursen
Todd Lusk
Joe Sapletal
Kent Tupper

Contacts

If you would like to write an article for the Spotlight section of the GIS News newsletter and share how you use GIS in your department, call or email Randy or Julie.

Randy Knippel
952.891.7080
Randy.Knippel@co.dakota.mn.us

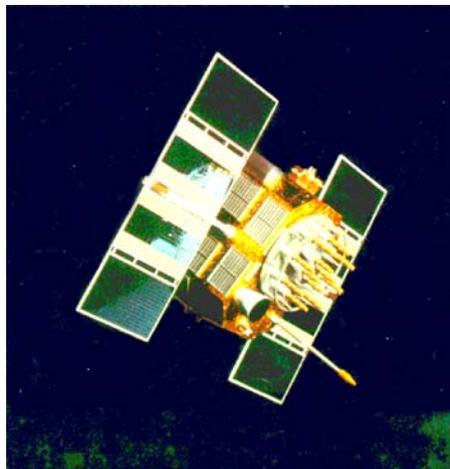
Julie Daugherty
952.891.7086
Julie.Daugherty@co.dakota.mn.us

GIS 101

What is GPS?

by Kent Tupper

The NAVSTAR Global Positioning System (GPS) became fully operational on April 27, 1995. It is a constellation of 24 satellites operated by the *U.S. Department of Defense*, which are transmitting radio signals.

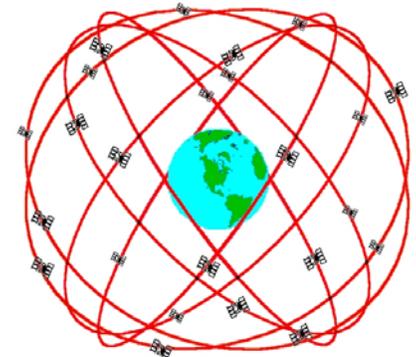


Global Positioning System Satellite

There are 21 navigational satellites and 3 active spares in orbit. The 24 satellites are arranged in a constellation orbiting at 10,900 nautical miles above the earth. The satellites are arranged in 6 orbital planes of 55-degree inclination and take 11 hours and 58 minutes to complete orbit. This pattern allows a receiver, under normal conditions, to receive the signal of at least 4 different satellites. A satellite emits a signal at regular intervals using an internal atomic clock. The receiver can identify the transmitting satellites by those signals, and therefore determine the satellite's known position in space. Then by using that information, the exact location of the receiver can be calculated.

Although the GPS system was

originally designed for military use only, due to an airplane accident in 1983 President Reagan released the signal for aviation and other transportation applications. Today the signal may be used by everyone without charges or restrictions.



GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

History of GPS

The concept of satellite navigation was conceived following the launch of the first satellite, Sputnik, in 1957. Scientists at the Applied Physics Laboratory of Johns Hopkins University (APL) developed a method of tracking the satellite's orbit by observing the radio signal broadcast by Sputnik I. By reversing this process, it was proposed that a navigator's position could be determined by tracking the radio signal broadcast by a satellite that had a precisely known orbit. The U.S. Navy was quick to take advantage of this new technology to provide accurate position updates to ships and submarines around the globe. The US Navy's Transit satellite navigation system became operational on U.S. Polaris submarines in 1964. The Transit navigation system was only available roughly every 40 minutes and users had to be nearly stationary to get an accurate navigation fix. With the

(continued on page 2)

(continued from page 1)

development of precision atomic clocks in the 1960s, it became possible to design a satellite constellation, which carried a network of clocks precisely synchronized to a common time reference. Continued development throughout the 1970's led to the NAVSTAR GPS system of today.



Handheld GPS Receiver

How GPS Works

The basis of GPS is triangulation from satellites. The satellites transmit signals that can be detected by anyone with a GPS receiver. To "triangulate," a GPS receiver measures distance using the travel time of radio signals. To measure travel time, GPS needs very accurate timing. Along with distance, the exact location of the satellites in space must be known. Finally corrections must be made for any delays the signal experiences as it travels through the atmosphere. Today, accuracy ranges from 20 meters to less than a centimeter depending upon the application.

The use of GPS has been invaluable for Dakota County in building its GIS Database, saving time and improving accuracy. 🌐



Department Spotlight

The Vermillion River Watershed Map

by Todd Lusk

In the fall of 2000, Dakota County's Office of Planning, Survey & Land Information Department, Extension Services, and Soil and Water Conservation District along with the Minnesota Department of Natural Resources and Friends of the Mississippi River began the process of creating a product to educate people about the Vermillion River Watershed.

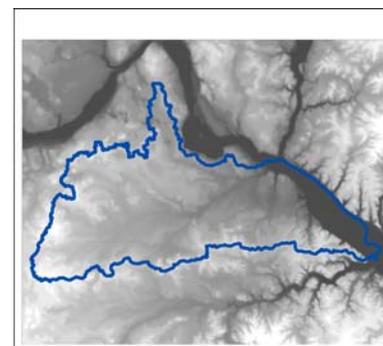
These six groups gathered to brainstorm ideas for creating a product that would educate people about their impact on the Vermillion River. The audience for the project was very broad and included watershed citizens, local officials, schools and other interested parties. The group wanted to encourage people to become familiar with their watershed.

Several different ideas, ranging from door hangers, to a mass mailing, to posters, were discussed as a means of communicating the message. Ultimately, a final consensus was reached on a poster. On one side of the poster would be a map of the Vermillion River Watershed. On the other side, drawings of "River Friendly Practices" which can help maintain a healthy river.



The goal of the map side of the poster was to show how the watershed is connected. Because the watershed encompasses both rural and densely

urban areas, the group felt it was necessary to portray this aspect of the watershed. On the reverse side of the poster was a hand drawing reflecting how watershed stakeholders can play a role in improving their watershed. The drawing depicts "river friendly" practices for various landscapes including suburban, commercial, industrial and agricultural areas.



Close-up of the DEM insert on the Vermillion River Watershed Map

The Vermillion River Watershed map was produced using ArcMap, a newer version of ESRI's ArcView GIS. Each component of the map was created individually, exported from ArcMap, and then imported into CorelDraw for final map layout.

The "River Friendly Practices" were hand-drawn, scanned, and then rendered using Adobe PageMaker. Final layout for this side of the poster was completed also using PageMaker.

Ultimately, the poster was sent to an offset printer for final publication. 2600 copies of the poster were printed. Of those, 2100 were folded into brochure rack size while 500 were left flat and laminated.

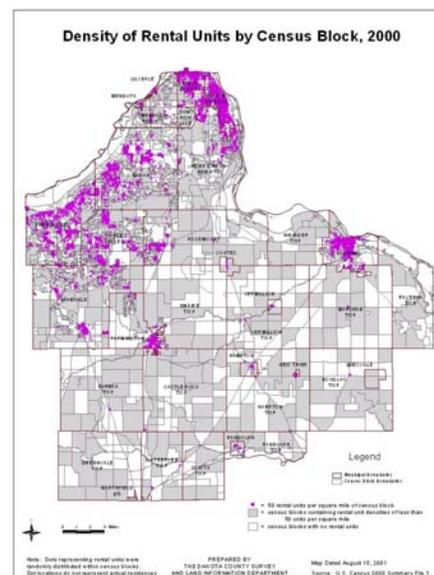
It is the goal of the County and the agencies publishing this new map to assist in informing the 148,000 Dakota County citizens who live within the watershed of its boundary and many of the issues affecting it. If you would like a free copy of this map please call the Dakota County Environmental Education Program at (651) 480-7747. 🌐

Desktop GIS

Census Update - What's New in Summary File 1 by Julie Daugherty

The Census Bureau used two different forms to collect Census 2000 data. A "short form" with seven basic questions went to all households. A "long form" with those same questions plus additional questions went to a sample of households. Summary File 1 (also known as SF1) is a summary of all information collected from all people and housing units.

there are population counts for single years of age instead of broad age groups. There are also population counts for combined age, race, and sex categories instead of separate tabulations by age, by race, and by sex. Many tabulations that had previously been summarized for the total population are now broken down by race. This information will be used by social scientists and planners to analyze trends in living arrangements, home ownership and residential patterns, and for projecting demand for health services, schools, highways, and retail products.



Rental Property Map created from SF1 data

Topics covered by SF1 include:

- Population by age, race, sex
- Population counts for detailed American Indian tribes, Asian races, and Hispanic ethnicities
- Population in institutions and other group quarter facilities
- Characteristics of households and families
- Living arrangements of children and senior citizens
- Unmarried partners
- Owner occupied/Renter occupied properties
- Housing vacancies
- Housing tenure
- Housing unit counts
- Vacancy rates

Additional summary files are scheduled for release from Fall 2001 through Spring 2003. Socio-economic and housing information obtained through the census "long form" is scheduled for release in Summer 2002.

As new data becomes available, new tables and maps will be added to the County's Intranet Census site <http://thor/census/>. To learn more about Census data visit the U.S. Census website at www.census.gov. To access census data tables, download data, and create maps on the fly, visit the [American FactFinder](http://www.census.gov) website.

A Page from the Census "Short Form" Informational Questionnaire

Summary File 1 presents 100-percent population and housing figures for the total population, for 63 different race categories, and for many other categories such as age, sex and family characteristics. It includes several levels of geography that were not included in the Census Bureau's initial data release for Dakota County. These levels of geography include individual blocks, census tracts, and zip codes. The new summary file also contains more detailed cross-tabulations than previous releases. For example,

Tech Talk

ArcView 3.2's Geoprocessing Extension by Scott Laursen

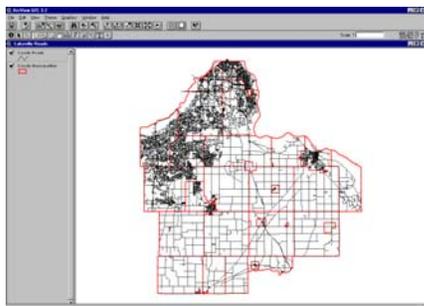
One of the more useful extensions available in ArcView 3.2 is the GeoProcessing Wizard. This helpful add-on lets users perform a number of different processes that create new themes based on the properties of one or two existing themes. ArcView users can already perform the Combine, Union, Subtract and Intersect processes on features within a single theme straight out of the box. The GeoProcessing extension allows the user to perform these and other processes using one theme to define the areal extent, features and attributes of a second theme. This is very useful when the user is trying to

(continued on page 4)

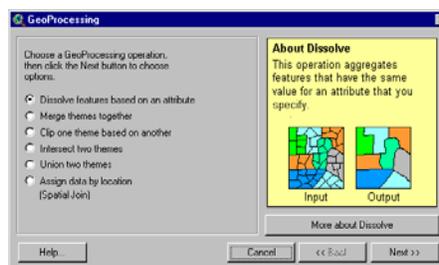
(continued from page 3)

combine information from multiple themes. For example, given one theme with all of the Dakota County roads and a second theme composed of all of the county's municipal boundaries, we can use the processes available in the GeoProcessing Wizard to create a new theme made up of just the roads in the city of Lakeville.

Let's go through that example in detail. First, we'll open the County Roads theme and the County Municipalities theme.



We do not need to start editing either theme, as we will be taking information from them both to create an entirely new theme. However, we do need to do some preparation work before we start. We will be using the Clip option, which allows us to use one theme as a cookie-cutter to define the area of the second theme that we want. Since our goal is to create a theme of the roads in Lakeville, we will be using the Lakeville municipal boundary from the County Municipalities theme as our cookie-cutter, and the County Roads theme will be the "dough" layer, the one that gets trimmed. In the Table of Contents, click on the County Municipalities theme and then go to the map and select the Lakeville municipal boundary. Next, we load the GeoProcessing extension (File > Extensions > Geoprocessing). Open the GeoProcessing Wizard (View > GeoProcessing Wizard...), and the following window opens:

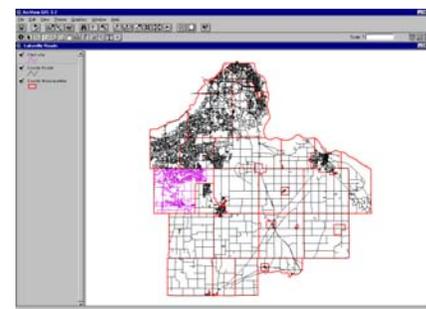


The wizard interface provides descriptions of each process in the yellow box on the right hand side and the "More about [process]" button below it. If you care to learn more about each of the operations, select them one at a time on the left hand side and then read through the descriptions that appear in these two areas. When you are ready to proceed, select the "Clip one theme based on another" option. Click *Next*. The following window appears:



For Step 1, we want to choose the theme that will be trimmed to our desired areal extent (the "dough" layer), so we would therefore choose the County Roads theme as our input theme. (Note that the "Use Selected Feature Only" option is grayed out and is unavailable.) Step 2 asks for our overlay theme, the theme that we want to use as our cookie-cutter to define the extent of the new theme. (Note that the overlay theme has to be a polygon layer – it is not possible to clip using a line or point layer as the overlay theme. Also note that no attribute information will be taken from the overlay theme; the new theme will consist only of the input theme's shapes and attribute information.) If it is not already selected, choose the County Municipalities theme as the overlay theme. Because we selected the

Lakeville municipal boundary before we started this process, the "Use Selected Features Only" box is already checked, and the message notes that we have selected one feature from the layer (the Lakeville municipal boundary). It is not possible to check this box once we have begun the GeoProcessing Wizard; that is why we had to select the Lakeville municipal boundary before we began. Step 3 is where we specify what our output file name and location will be. The default file name is Clip1.shp; to change it or the file location, click the open folder button and navigate to where you want to save the file. Now, click *Finish*. When ArcView finishes creating the new theme (named Clip1.shp), ArcView automatically adds it to our view.



As you can see, we have created a new theme consisting only of those roads in the City of Lakeville. All of the attribute information for those roads has been preserved from the original County Roads shapefile.

Clipping is one of the simplest operations available in the GeoProcessing Wizard. Other operations include Merge, which creates a single theme by appending two themes to each other; Union, which combines the features and attributes of two overlapping themes; and Dissolve, which combines features of a single theme based on a specified attribute. Each of these operations can make your life as an ArcView user easier and less frustrating – try them out for yourself! 🌐