GRASS Tutorial: `g.gnuplot`*

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Abstract

Necessary for many types of statistical analyses is the ability to analyze results and/or make decisions based on graphic display of data. Because of this basic need in a GIS and because of GRASS' lack of such a facility, a solution was sought. This document outlines some of the specifics of the GRASS terminal for `gnuplot` including how to plot GRASS data. It is not a substitute for the on–line help and the GNUPLOT manual (distributed with the source).

1 GNUPLOT Interface to GRASS

GNUPLOT is an interactive, scientific plotting program that, although is copyrighted, is freely distributable. Among its capabilities are semilog, log–log, surface, and contour plots. It can plot actual data files or functions built up of C operators, C library functions, and other constructs. Output devices include X11, LaTeX, VGA, pic (*troff*), Tektronix, and many more. Each of these devices require a *terminal driver*, which are tied to a standard interface of GNUPLOT's plotting engine. The program is very well–designed so that the *guts* of the program specify graphics in a very general, device–independent manner. Then, the terminal drivers, using the standard library functions of GNUPLOT, are used to create the output, whether on the computer's screen or on paper.

The graphical display portion of GRASS is set up in a very similar manner. Because of good designs of both GNUPLOT and the GRASS Display programs, creation of a GRASS terminal driver for the GNUPLOT plotting program was straightforward.

So, instead of having to use an external program to plot data files or functions, the GNUPLOT engine runs using the GRASS Display Device (selected by `d.mon`).

2 Applications

A plotting interface to the GRASS monitor is useful for many applications. The GRASS monitor is a convenient way to display scientific graphs during a GRASS session–perhaps related modeling or analysis. Other drivers are available in addition to the GRASS monitor, many of which are useful for importing graphs into other software. Therefore, the user's `g.gnuplot` input files may be used with GNUPLOT; backward compatability is not a problem. Also, GNUPLOT may be used as a replacement for a GRASS Paint program. GRASS Paint programs produce raster output which, while good for some situations, can be cumbersome if the number of printed maps necessary for a publication become large. Because of demanding memory requirements, the loss of quality during rasterization (of vector data and annotations), a user may want something different for papers and journal articles. The `g.gnuplot`/GNUPLOT combination becomes useful in these situations.

The following sections describe two example applications using the Spearfish dataset: contouring GRASS raster files and plotting of GRASS vector files.

*from *Spatial Statistics and GRASS*, a report for Agricultural Engineering 590 (Spring 1993), an independent study course at Purdue University supervised by Dr. Bernie Engel.

2.1 Contouring Cell Files

Cell files can be plotted as surfaces, contours, or any combination of the two. The initial problem that someone unfamiliar with GRASS and GNUPLOT may have is transformation of the data into a suitable format. The procedure below, used to produce the GNUPLOT data file for figure 1, can be used as a guide.

```
g.region -p > /tmp/region
set n=`grep north /tmp/region | colrm 1 12`
set s=`grep south /tmp/region | colrm 1 12`
set e=`grep east /tmp/region | colrm 1 12`
set w=`grep west /tmp/region | colrm 1 12`
set nsr=`grep nsres /tmp/region | colrm 1 12`
set ewr=`grep ewres /tmp/region | colrm 1 12`
cat >! /tmp/awk$$ << EOF
$2 != row{print "";row=$2}
{print s-nsr*$1, w+ewr*$2, $3}
EOF
r.stats -1x elevation \
 | awk -f /tmp/awk$$ s=$s nsr=$nsr w=$w \
 ewr=$ewr > ! elevation.dat
```

Contouring of Elevation in Spearfish

Figure 1: Contouring raster files with GNUPLOT.

This method of representing a raster image in a report or journal article may be preferred over using Paint programs. Flexibility is certainly greater. For example, if a user wanted to show both slope and elevation, two surfaces could be plotted. For expository purposes, this may be preferable to overlaying the files and showing a raster image with a legend.

2.2 Plotting Vector Files

Using the utility `v.out.ascii`, vector files can be maniuplated to a format suitable for GNUPLOT. Again, some example code (an `awk` program), is given below to aid in this transformation:

```
BEGIN { n=-1; segments=0; }
{
  if (NR > 14)
  {
```

```
        if ($1 == "A")
          n=segments=$2;
        else if ( n != segments )
        {
          if (n%2 == 1)
          {
            printf "%s %s\n", prev_b, prev_a;
            printf "%s %s\n", $2,$1;
          }
          else
          {
            printf "%s %s\n", prev_b, prev_a;
            printf "%s %s\n", $2,$1;
          }
          prev_a=$1;
          prev_b=$2;
          print "";
        }
        else
        {
          prev_a=$1;
          prev_b=$2;
          n--;
        }
      }
    }
```

Running this **awk** program on the ASCII vector file and using the **s.out.ascii** program, the plot in figure 2 was obtained.

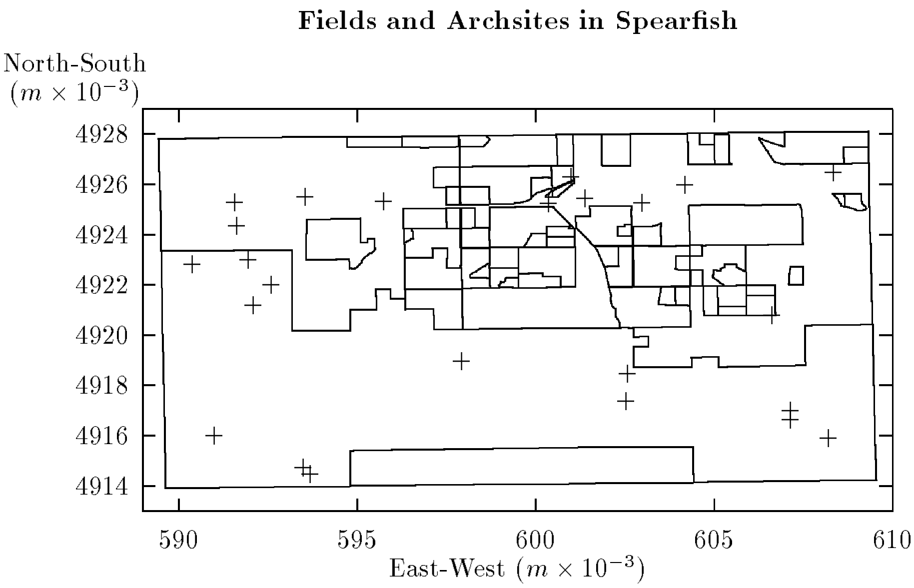

Figure 2: Plotting vector files and sites lists with GNUPLOT.

Table 1: Line and points types for `g.gnuplot`.

#	line type	point type
0	white	dot
1	red	"x"
2	green	"+"
3	magenta	box
4	brown	diamond
5	orange	triangle
6	yellow	circle
7	blue	inverted triangle
8	violet	filled box
9	gray	filled triangle
10	—	filled inverted triangle
11	—	filled circle

3 Details about `g.gnuplot`

General usage information about `g.gnuplot` are identical to those of GNUPLOT. For more information about GNUPLOT, see the see the *GNUPLOT Manual* or the USENET group `comp.graphics.gnuplot`. The source code and manual for GNUPLOT is available via anonymous ftp from `dartmouth.edu`.

Additionally, Table 1 describes the line and point types available with the GRASS terminal. A total of 10 line types and 12 point types are available.