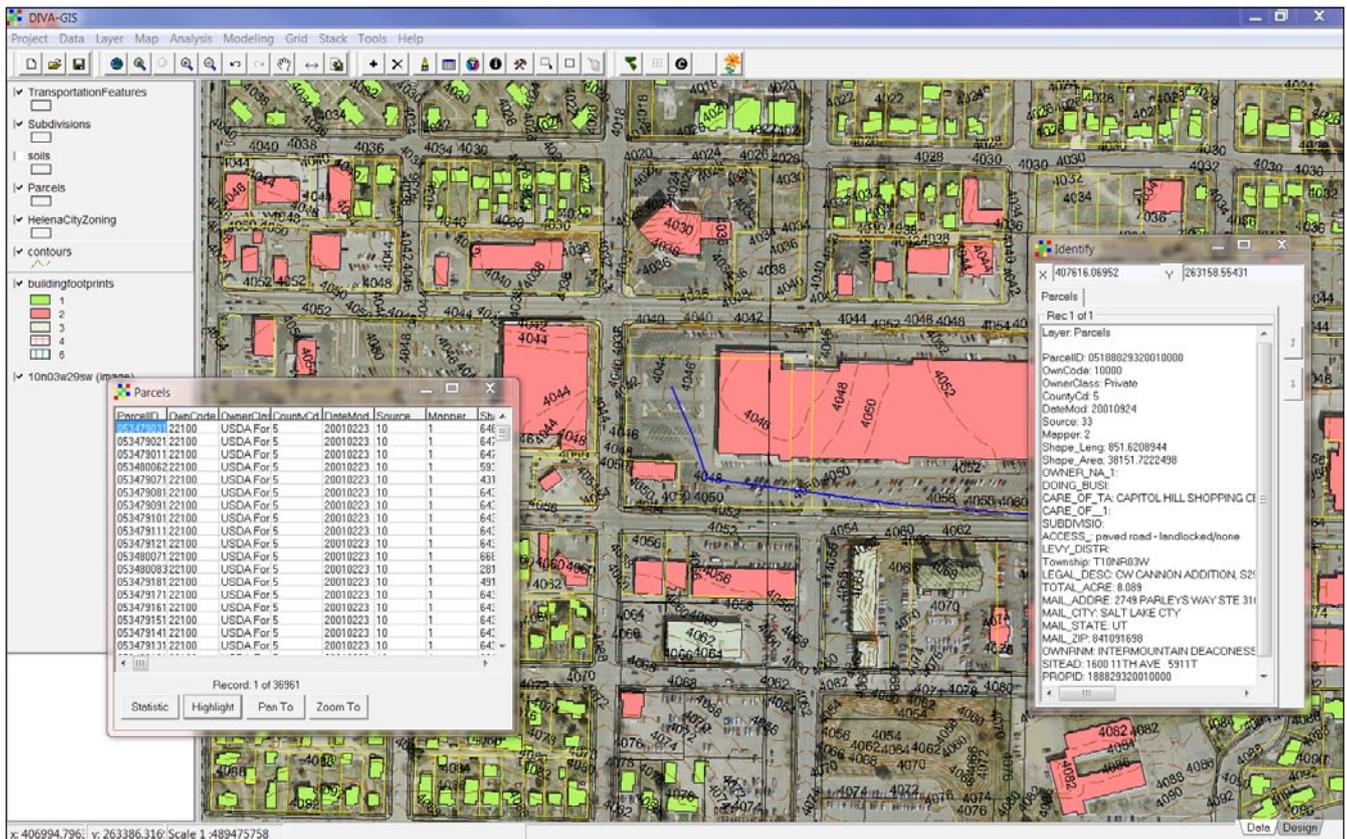**By Rj Zimmer, LS**

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Something for Nothing

DIVA-GIS

This article compares several free GIS software programs related to types of data management and map production activities of interest to the land surveyor. The list is not comprehensive; I simply chose to test and compare the software that is easy to find on the Internet, readily available, easy to download, and simple to install. While I have undoubtedly probably left out somebody's pet program, my mission here is not to root out the deeply hidden gems on the Internet, but to inform readers of the advantages of the applications that are easy to find. The primary limiting factor in my selection is that the software must be completely free of charge to download and run. I did not test any free-trial software that limits the duration of use, or the number of files one can load.

The four I tested are ESRI's ArcGIS Explorer, DIVA-GIS, Google's Google Earth, and Quantum GIS. There were a few other free GIS tools that I downloaded, installed, and tried to add data to, that were too complicated to set up to load existing datasets, or required too much command line typing with arcane syntax to be easy and quick to use. In this era of software, my mantra is *keep it simple*. If the software is simple to use and understand and provides a few essential functions, then people will readily adopt it. Google Earth for example, meets those criteria, and that is why it became so popular so quickly.
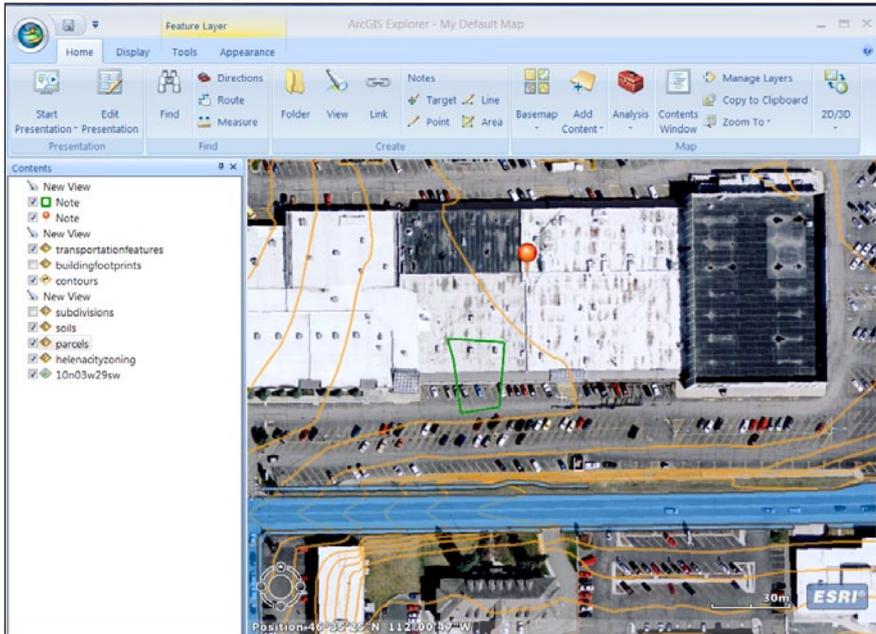
ArcGIS Explorer

Software that is difficult to learn or that takes a long time to learn must offer something very compelling to motivate people to invest the time and effort, and usually the money for training to become competent with it. In this series, our focus is on introductory instruction in basic GIS tasks to help the surveyor take advantage of the GIS technology. As you become more adept with GIS and your understanding of the capabilities and power of GIS increase, you may then want to do sophisticated data management, editing, and analysis. When you get to that point, you will be ready and perhaps eager to invest in better software and to get the training to learn to use it.

The perspective that I used for testing was that of surveyor creating a map of a property for a client using free GIS software and GIS data that may be available locally. The deliverable products include: a paper map, a PowerPoint slide or two showing the property location in general, the property boundary with annotated features on an aerial photography base, a zoning map, and other relevant data.

The functions that I considered reasonably necessary to accomplish this include: the integration of vector data, geo-registered imagery, custom symbology, custom annotation, professional quality map cartography, and the ability to copy the map to the Windows clipboard and then paste that into PowerPoint.

Some of the operations and functions that are helpful to get to that point include: the ability to import an AutoCAD DWG or DXF, or an ASCII file of points, the ability to zoom and pan around the map, the ability to annotate a map layout and insert map elements (such as north arrow, scale, legend, custom title, etc.), and the ability to search for specific information or a particular location.

Other helpful functions include some GPS operations such as the ability to connect to a GPS stream or import GPS data. The ability to export data to GPS is helpful for taking the GIS data into the field.

I also listed a few functions that one might want to perform such as editing the geometry or attributes of a layer, and some types of analysis such as buffers and network analysis.

I used the following existing data for the testing because I felt these were representative datasets with regard to content and format:

- Parcels (vector polygon shapefile)
- Subdivision boundaries (vector polygon shapefile)
- Aerial photography (digital ortho-imagery)
- Digital elevation model (raster elevation data)
- Zoning (vector polygon shapefile)
- Roads (vector polygon shapefile)
- Building footprints (vector polygon shapefile)

- Well location (GPX file from handheld GPS)
- Contours (vector AutoCAD dwg or shapefile)

ArcGIS Explorer

Over the years, ESRI has provided numerous versions of the free GIS Explorer utility as a GIS viewing tool. The Explorer series has been available in various flavors tailored to slightly different audiences, but in all cases is essentially a free utility for browsing existing GIS datasets and making simple maps. You are never without data when using ArcGIS because ESRI provides base map content, via map services, of aerial imagery, topography, and roads. It may not be the exact data you need, but they provide lots of content.

ArcGIS Explorer successfully loaded all the sample data sets except for the DEMs and AutoCAD DWG files. ArcGIS Explorer is limited in its ability to customize the symbology of features and does not allow the labeling of features based on attributes, but rudimentary maps can be made that can be printed to large format, exported to an image file, or switched in the ArcGIS Explorer display to "presentation" mode to show the map (or maps) as a slide show.

ESRI's various iterations of free GIS data viewers have offered different tools and different capabilities, and simultaneous releases of the Explorer series that are produced using different foundation technologies don't all have the same capabilities.

DIVA-GIS

I like DIVA-GIS very much. Although this software was designed primarily for environmental analysis, it is such an easy-to-use and powerful tool that I think surveyors would find it worth taking a look at. DIVA-GIS loaded all the GIS layers in the sample data set, except the DEM and AutoCAD DWG formats, however DIVA-GIS does read a GRD format for elevation data and has many analysis tools for that format. I did not have any GRD format sample data so I was not able to test the tools.

DIVA-GIS does a great job of rendering the GIS data and imagery into visually pleasing maps—on screen and printed (even at E size). Additionally, DIVA-GIS provides many tools for query and analysis, and supports all the essential map elements (*e.g.*, scale, north arrow, legend) for a customizable
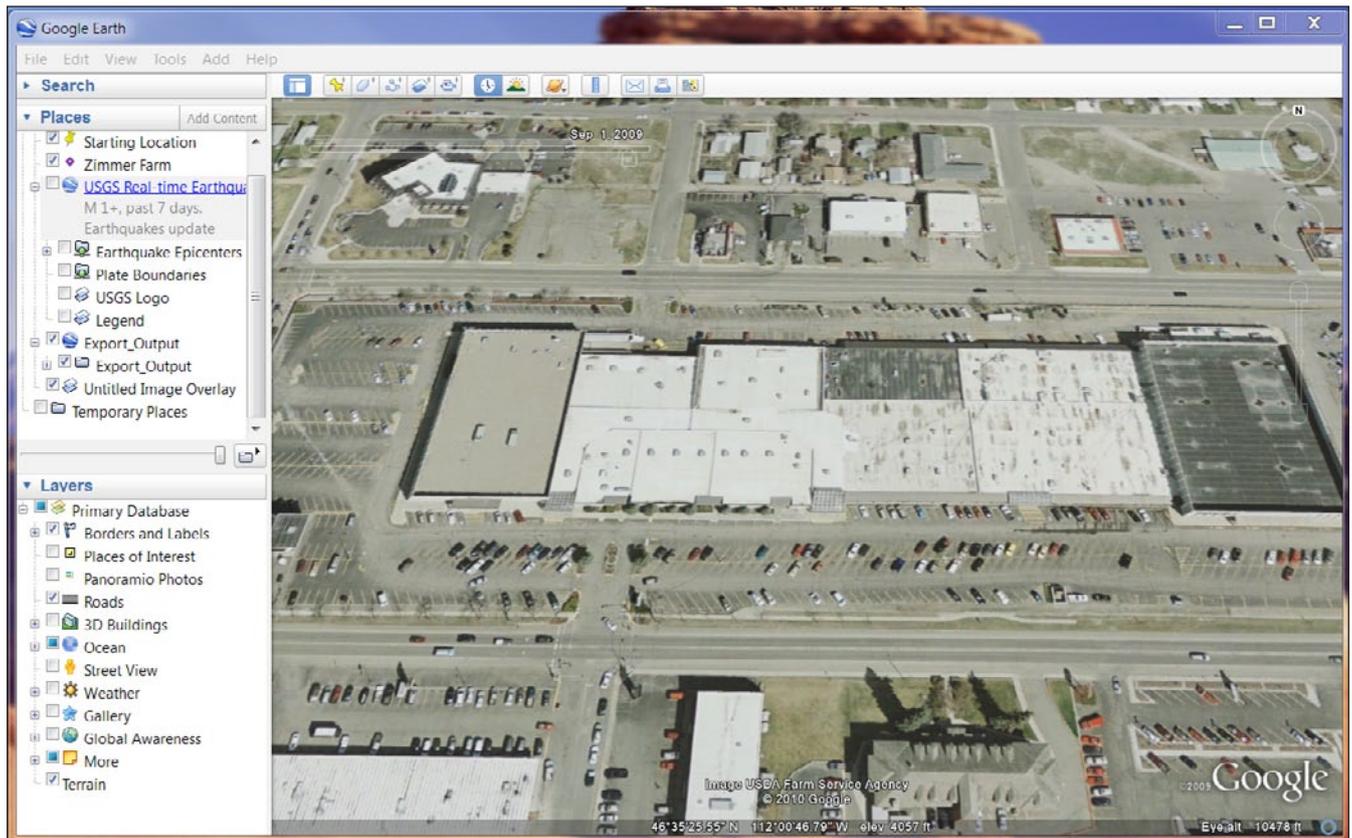
Google Earth

map for presentation. The paradigm DIVA-GIS uses for map presentation is a two-tab data/design perspective, where the design tab is for designing a map for presentation of the data that are in the data tab, along with optional title, text, north arrow, etc. The data tab is where you load GIS data and perform the many query and analysis tasks. Additionally, DIVA-GIS does provide tools to export maps and data to a few formats, and, although I didn't test this, one may also export the data to a shapefile, which could be very useful. I liked DIVA-GIS because it packed a lot of punch and the price is right!

Google Earth
My guess is that by this time, most surveyors know about and use Google Earth. Google Earth caused a tsunami in the GIS world when it came out a few years ago by providing free GIS tools with a powerful 3-D mapping engine that was simple to use. It provides quick, easy access to imagery and terrain data worldwide, and presents several other informative data sets as well, such as place names, addresses,

political boundaries, etc. Additionally, anyone can instantly add their own data by simply clicking on the map and typing in some information or adding photographs or other data types, or one can create their own Google Earth-compatible datasets using any number of free tools to generate KML or KMZ formatted data.

Simple-to-use also means limited capabilities, so the free version of Google Earth does not read shapefiles, AutoCAD files, GPX formats, DEM, and others; it basically didn't read any of my sample data except the ortho-rectified imagery (which it did automatically place in geographic space at the right location and orientation). Free Google Earth does not support large format printing or GIS spatial or attribute analysis. I like Google Earth and I use it a lot, but for the type of project in the software comparison, Google Earth was of very limited use.

Quantum GIS
I did not fully test Quantum GIS. I did download and install it, but the software was too complicated to use "right out of the box", and I did not have the time to

learn to use it. I figure that if you need to invest a lot of time in learning to use a product, then it should be able to deliver everything you that you need to do. Based on the literature on Quantum GIS, I did not think that would be the case.

Side-by-side Comparisons
I did all the testing on a Windows 7 operating system, with 8 Gb RAM, and 1 Gb of video memory, and a fast Internet connection (15Mbps). None of the software tested failed to install or run on my Windows 7 machine, although there were occasional burps and hiccups, such as a button to close a window not functioning, or some text crowding, or color fill displays that were offset or shifted a little from the correct position.

Conclusions
Based on my experience with these versions of the software and the sample data that I used for this testing, I would recommend DIVA-GIS because of its power suite of tools, its ability to read so many file formats, its ability to generate decent presentation maps, and its ability to write to various GIS formats.

My second choice would be ArcGIS Explorer, mainly due to its ability to connect to online map services for accessing more data, and the potential to access some online analysis tools (which I did not test).

There were a few other free GIS software products available, which I did not test, some of which might be worth checking out perhaps. Nevertheless, I hope that you will find this review helpful for getting started with some free GIS software.

Bear Tales–Fuzzy Boulders
And now for another bear tale. One of my favorite spring hikes is up Copper Creek, outside of Lincoln, Montana.

The road takes off from the highway and follows the Copper Creek drainage into the national forest for about 15 miles, and then a trail follows an old Jeep road past a couple abandoned copper mines to the ridge top at the boundary of the Scapegoat Wilderness. There are only a few trees on top of the ridge and the wilderness side of the ridge is a precipi-

Availability of Common Functions

		ArcGIS Explorer Build 1200	DIVA-GIS 7.1.7 beta	GoogleEarth 5.1.3535.3218	Quantum GIS 1.40
VERSION TESTED	Windows	✔	✔	✔	✔
	MacOS	✔	✔	✔	✔
	Linux	?	?	✔	✔
VIEW FILETYPES	Shapefile	✔	✔	✘	✔
	ASCII	✔	✔ (to points or to lines)	✘	?
	Images	✔	✔	✔	✔
	Can geo-reference image	?	✔	✔	?
	DWG	?	?	✘	?
	Raster DEM	?	?	✘	?
	DXF	?	?	✘	✔
	KML/KMX	✔	?	✔	?
	ESRI geodatabase	✔	?	✘	?
	map services	✔	?	✘	?
	MIF (MapInfo)	?	?	✘	✔
	SDTS	?	?	✘	✔
	GML	?	?	✘	✔
	Excel	?	✔	?	?
VIEW TOOLS	Zoom In	✔	✔	✔	?
	Zoom Out	✔	✔	✔	?
	Pan	✔	✔	✔	?
	Zoom Full Extents	✔	✔	✔	?
	Zoom Extents of layer	✔	✔	✔	?
	Identify	✔	✔	✔	✔
	Turn layers on/off	✔	✔	✔	?
	Find	✔	?	✔	?
	Find location	Address, coordinate, placename	?	✔	?
EDIT	Create feature geometry	✘	✔	✔	GRASS/Shapefiles
	Create feature attributes	✘	✘	✔	?
	Create point geometry from delimited text file	✘	✔	✔	✔
	Populate feature attribute table with values	✘	✘	✘	?
	Delete features	✘	✘	✔	?
	Delete attribute values	✘	✘	✔	?
	Modify feature geometry	✘	✘		?
	Move features	✘	✘	✔	?
	Edit vertices	✘	✘	✔	?
	Rotate features	✘	✘	✘	?
	Modify feature attributes	✘	✘	✔	?
	Georegister features	✘	Images	✔	Plug-in
	Spatially align features	✘	✘	✘	?

✔ Function Fully Available and Included   ✘ Function Not Available   ? Unable to Verify

tous drop into the wild country with no roads and no trails for miles. There is no marked trail here but the ridgeline is open country with miles of peaceful hiking that has unlimited views of the mountains and valleys. The geology produced many bluish-green rocks and dark red boulders scattered about the area, and the abandoned copper mines still yield a few interesting rocks—some that are bright blue.

As with most places in Montana, there are very few people when you get off the roadways, so once I get to the top of the ridge I am all alone on the edge of the wilderness. One spring morning a few years ago I took this hike with the intention of following the ridgeline to the top of Red Mountain. I like this route because it is high on the ridge and open country the entire route, so the views are part of the incentive. I

had driven my truck as far up the road as possible, then hiked to the top of the ridge. I followed the ridge, which is quite narrow in some parts, then I scaled a cliff up onto a sort of plateau that sloped gently one direction, which had a small grove of trees and dropped steeply into the wilderness on the opposite side. I decided to take a break from hiking and sat on the cliff with my binoculars to scan the forest below for wildlife.

	ArcGIS Explorer Build 1200	DIVA-GIS 7.1.7 beta	GoogleEarth 5.1.3535.3218	Quantum GIS 1.40
CREATE MAPS				
Print what is shown on the screen	✔	✔	✔	?
Copy to clipboard the map shown on the screen	✔	✔	?	?
Add map elements (North arrow, scale bar, etc.)	✗	✔	✗	?
Set desired map scale	✗	✔	✗	?
Add custom title	✔	✔	✗	?
Set vector symbology	✔	✔	✔	✔
Set raster symbolgy	✗	✔	✔	✔
Label features using attribute values	✗	✔	✔	✔
Insert text at desired location	✗	✔	✔	?
Symbolize features based on attribute values	✗	✔	✔	?
Project on the fly	✔	?	✔	✔
Set layer transparency	✔	?	✔	?
Print large format	✔	✔	✗	?
Print to PDF	✗	✗	✗	?
Save Map Projects	✔	✔	✗	✔
Set Scale Dependencies	✔	✗	✗	?
GPS SUPPORT				
Import GPS format				
CSV	?	✔	?	?
GPX	✔	✗	✔	✔
Connect to GPS	?	✗	3rd party plug-in	✔
Export to GPS format				
CSV	?	✗	✗	?
GPX	?	✗	✗	✔
REPORTS				
Attributes based search	✗	✔	✗	?
complex SQL queries	✗	✔	✗	?
generarate list of matched items	✗	?	✗	?
print list of matched items	✗	?	✗	?
Graphically select features	✗	✔	✗	✔
Measure tools	area, length, path, elevation	✔	✔	?
GIS ANALYSIS				
Points in polygon	?	✔	✗	?
Nearest Neighbors	?	GRID	✗	?
Network Analysis	?	?	✗	✔
Terrain Analysis	?	GRID	✗	✔
Buffer	buffer point	?	✗	?
Hydrologic Modeling	?	?	✗	?
Intersect	?	GRID	✗	?
Others	can use ArcGIS Server publishd tools	Cut, Merge,	✗	?

Author's Note: The Quantum GIS information listed on the comparison matrix is based on the help files and literature provided by the Quantum GIS developer group, none of which I tested.

Websites

Before long I spotted a grizzly bear working his way up the mountainside on a ridge that T'd into the ridge that I was sitting on. The bear was probably a half mile away in the trees and a long way from my probable hiking route, so I sat and watched him for a while. I then spotted another grizzly in the same area, also working his way through the forest looking for food. I sat on the cliff enjoying the spring weather, watching the bears for about twenty minutes, when it occurred to me that I was in a vulnerable position—sitting on the edge of a cliff, looking through the binoculars and having no idea what might come up behind me. I got up and looked around to make sure that I was indeed alone on the top of the ridge. After scanning the ridge around me and checking out the small grove of trees, I knew I was okay. Then I decided to resume my hike. From where I was, the ridgeline climbed a small hill then dropped gently through a saddle before climbing steeply for the next couple of miles. I started climbing the hill, and then decided to be cautious of bears—just in case. As I neared the top of the hill, I stopped to look down into the saddle with my binoculars. I did not see any wildlife—just a few large red boulders, like the ones that I had seen earlier on my hike. Then one of those red boulders did something odd—it moved! Then another red boulder moved! I got a little closer, steadied my binoculars, then saw that the boulders were actually two grizzly bear cubs, and mama grizzly was there with them! The three bears were about three hundred yards away from me, and they were exactly on my route to Red Mountain. Fortunately, for me, none of the bears was aware that I was there. I decided against chasing the bears off my trail—that just wouldn't be polite—so I turned around and beat a hasty retreat back across the ridge, then back down the cliff, constantly checking behind me for angry mama bears. After I got to the bottom of the cliff and across the knife-edge ridge, I felt safer, but my hike to Red Mountain would have to wait another day. Despite having to abandon my hike, I felt extremely lucky to have seen five grizzlies in one morning outside of a national park. ⒶＳ