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OPEN SOURCE GIS FOR ARCHAEOLOGY

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Introduction

Archaeologists have made use of Geographic Information Systems (GIS) for more than two decades (Aldenderfer 1987). However the costs of commercial GIS software (e.g. ESRI products like Arc/View and Arc/GIS) have generally been prohibitive. While anthropology departments, other institutional users and some archaeological consultants have been able to purchase proprietary commercial software, anecdotal information would suggest that individual archaeologists have commonly gone without, or have acquired commercial software by other means.

While some free or open source GIS software has been available for a long time (e.g. GRASS – the Geographic Resources Analysis Support System, www.grass.itc.it), its use has often been limited by complexity, command-line driven interfaces and/or the constraints imposed by running on specialist operating systems like Unix/Linux. However in the last several years there has been much progress in the development of user-friendly versions that run on Windows and Mac systems. Much of this innovation has come out of university research projects and increasingly, government sponsorship of software projects aimed at replacing expensive, proprietary commercial software with open source solutions.

This brief report identifies two such software applications, QGIS and gvSIG, and how they may be useful to the archaeologist. The author has used these products over several years for displaying environmental and archaeological data, overlaying such data with scanned aerial images and historic survey plans, producing marked-up maps for reports and presentation, and undertaking limited spatial analysis.

What follows presupposes familiarity with some of the basics of GIS and computer usage and does not seek to introduce GIS or GIS analysis to new users. However for those unfamiliar with GIS concepts, useful discussions may

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be found in Aldenderfer 1987, Aldenderfer and Maschner 1996, Allen et al 1990, Lock and Stancic 1995 and Maschner 1996.

Quantum GIS

Quantum GIS or QGIS (http://www.qgis.org/) is an open source, user-friendly GIS based on the GRASS GIS. QGIS runs on Windows, Mac, and Linux systems and may be installed and run on a USB memory stick. This means that it is highly portable and can be run on networked computers where software administration privileges may not be available. Development of the software began in 2002 with new releases being launched several times a year to allow for new functionality and software bug fixes (one current idiosyncrasy for users running Windows Vista is that when you install the software you must right-click the install file and run the installation as administrator).

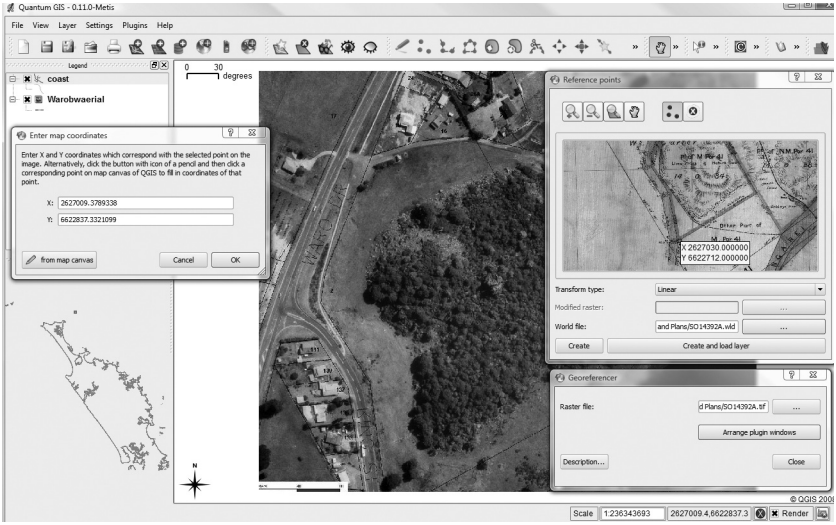

Figure 1. Geo-referencing historic survey plans with modern cadastral data and aerial images in QGIS.

QGIS allows the user to browse and edit vector, raster and database files including the most common GIS file format, the ESRI shapefile. It also allows the creation of new vector files in GRASS format and has GRASS database support. However it does not have the ability to create new shapefiles from scratch.

QGIS can create GIS layers from any GPS unit which can export data in the standard GPX data format. It can also download data directly from

Garmin GPS units. This means that almost all users of consumer-grade handheld GPS units can get data into QGIS with relative ease, assuming they have a download cable. Data can also be imported from event tables (e.g. text files of coordinates and other information which may be created from spreadsheet and database files).

QGIS also allows for the speedy geo-referencing of raster data like scanned maps and plans, allowing old maps and survey plans to be overlaid with modern topographic data. Maps can be created with common cartographic elements like scales, north arrows and keys. These can then be saved in common image formats like jpeg and png.

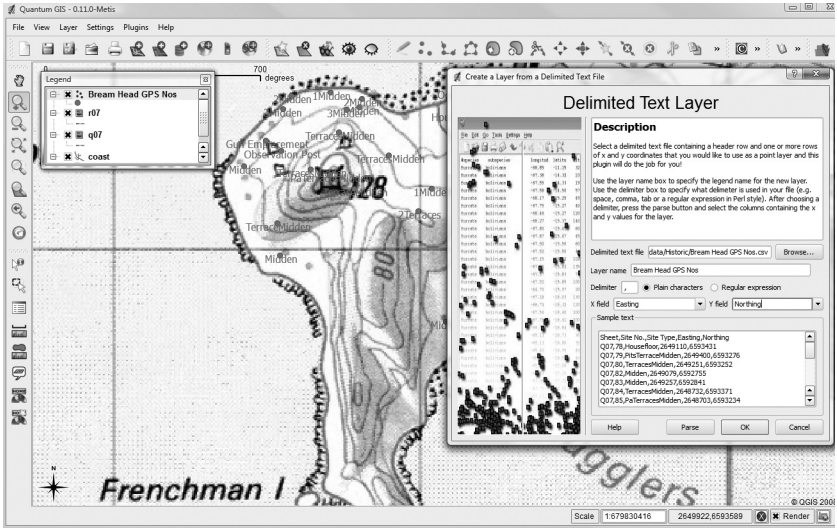

Figure 2. Importing a comma separated text file of archaeological sites and coordinates into QGIS.

gvSIG

gvSIG (http://www.gvsig.gva.es is a more complex product that offers much of the same functionality of Arc/View 3. The name stands for Generalitat Valencia Systema Informationale Geographica, and the software is being developed as an Enterprise-level GIS for the local government of Valencia in Spain. As part of migrating GIS services from commercial software to open source – the overall project is referred to as gvPONTIS – the Generalitat Valencia and a consortium of universities and other institutions have developed gvSIG as

open source, java-based, GIS system. It currently has 1200 institutional users and 80,000 individual downloads.

At first glance, the software appears very similar in layout and functionality to Arc/View 3, with a project manager window providing access to GIS data viewing, map layout and table tools. From the GIS and table screens, the software can create, import/export and edit GIS including ESRI shapefiles, and DXF, DGN and DWG CAD files. It can create, edit, and perform geoprocessing operations (buffering, spatial joins and intersections etc) on GIS layers, and georeference raster images.

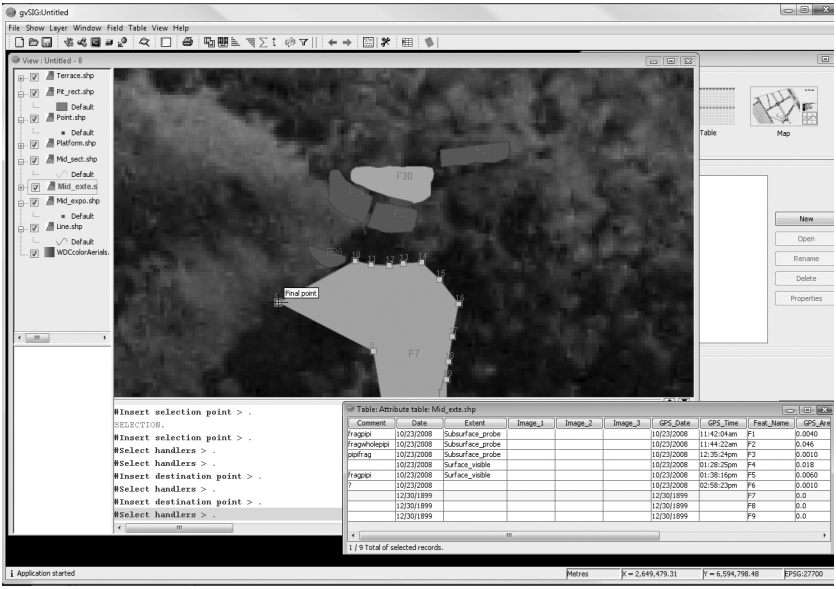

Figure 3. Editing archaeological feature attributes in gvSIG

There are third party extensions allowing raster and network analysis and 3D visualisation and gvSIG is especially powerful when combined the Sextante extension module, based on the SAGA GIS. SAGA/Sextante offers more than 30 tools for data conversation and spatial and network analysis (e.g. converting points, lines and polygons, viewshed and cost path analysis, the creation of TINs and DEMs, etc). SAGA may be found at http://www.saga-gis.uni-goettingen.

de/html/index.php. Sextante now comes pre-installed as part of the most recent builds of gvSIG, or is available separately at www.sextantegis.com.

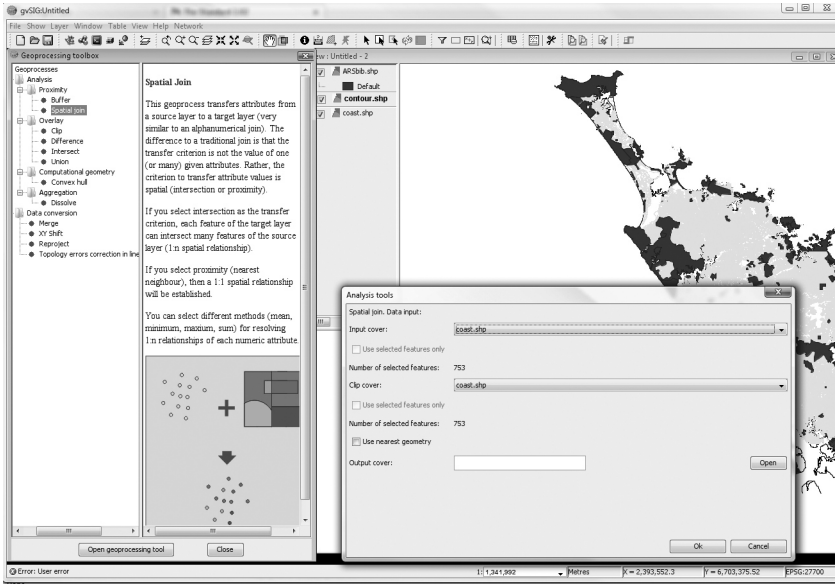

Figure 4. Geoprocessing operations in gvSIG.

The map making abilities of gvSIG are more advanced than QGIS and the Layout screen in gvSIG allows for the production of sophisticated maps using a variety of drawing tools and options for inserting cartographic and other elements. Maps may be exported as postscript and pdf files.

GVsig also has extensive database functions allowing for web-based mapping and working with remote geographic data. Recently, a mobile version of gvSIG with GPS functionality has been released for PDAs, as competition for ESRI's Arc/Pad product. With minor edits to the gvSIG initialisation file gvSIG can also be run from a USB memory stick.

gvSIG is somewhat unstable under the Windows VISTA operating system, particularly with raster data. For those running Vista, the Oxford Archaeological Unit has taken the core components of gvSIG, tweaked it for Vista and added Sextante into its own freely available build, available at http://

oadigital.net/software/gvsigoade. Another version for Vista is available at www.gvsig.org/web/plugins/downloads/gvsig-for-windows-vista.

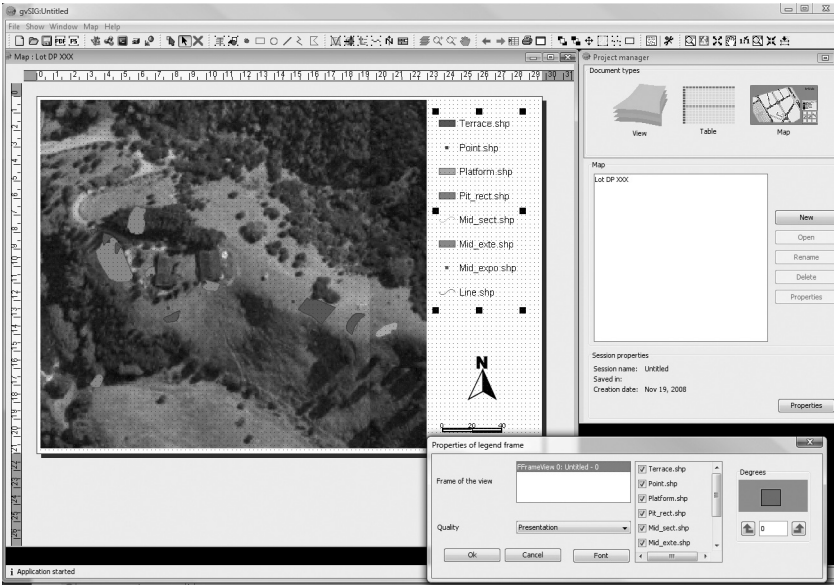

Figure 5. Laying out a map for publication in gvSIG.

Benefits and Drawbacks of Open Source GIS

The software described above is by no means perfect, and nor is it the only free or open source GIS available. There are a number of other products which the author has used, including Mapwindow, UDIG, JUMP, and GRASS . A new version of GRASS that runs in Windows using the Cygwin Linux emulator has been released recently. All of these have different strengths and weaknesses and it may be that the committed user will run different programmes for different operations with the same data. For a fairly complete list of GIS software that is available, see http://en.wikipedia.org/wiki/List_of_GIS_software.

Chief among the drawbacks are the presence of software bugs, along with other idiosyncrasies of performance and operability. For all intents and purposes the software is never ‘finished’. While projects under active development continue to add extra functionality and tweak performance through the release of regular software updates, the downside is that there is usually a catalogue of software bugs and glitches to fix with every new iteration. Also, unlike commercial software there is no helpline or professional support for

users experiencing difficulty, however internet forums provide opportunities to ask questions and share troubleshooting tips. The upside is that with all the source code freely available and distributable, programmers can create software builds with particular user groups in mind, or create plug-in extensions to do particular tasks and analyses.

For these reasons the software should not be relied on for critical tasks or managing large and complex datasets. Suffice to say that no single open source GIS has the equivalent functionality or reliability of the major commercial products.

Users will still also need to source base data for the software to be useful e.g. archaeological site locations, contour, river, road and other topographical data and raster version of topographic maps. Without access to this data the software is useless, although training datasets are available meaning they can be used for learning the basics of GIS.

In summary, for 'quick and dirty' display of spatial information, the creation of small datasets for managing small projects, and the one-off production of maps for reports and other publications the software described cannot be beaten on price. It will run on relatively modest PCs; can be installed and run from a memory stick; allows for the creation, editing and display of the most common GIS file formats; and allows for project data management and the production of maps suitable for many archaeological applications.

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