Geospatial Tools for the Home Citizen Scientist

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Can Amateurs do Science?

- Historically, much of science was done by amateurs. Professional scientist is a fairly recent job description.
- There are many options today to collaborate on data collection and data analysis.
- There are many software tools available to spatially and statisically analyze the data you collect/create

What can I do? Get your feet wet by helping existing projects.

- Data Collection – Geo-referenced field observations – GPS, notebook, and camera, cellphone uploads
- Analysis of Bulk data (look at historic ship logs , identify fish,etc)

Some existing projects..

- Zooniverse - https://www.zooniverse.org/ , transcribe historic ship logs for climate data, explore the ocean floor, explore the surface of Mars and the Moon.
- Scistarter - http://scistarter.com/ , Geowiki project, Serengeti Live, Build your own low cost infrared camera.
- Seabird Information Network http://www.seabirds.net/seabirdinfonetwork.html, online bird related databases for analysis, download, and submission of bird related data.

Geospatial Tools – Free Closed source :Google Earth

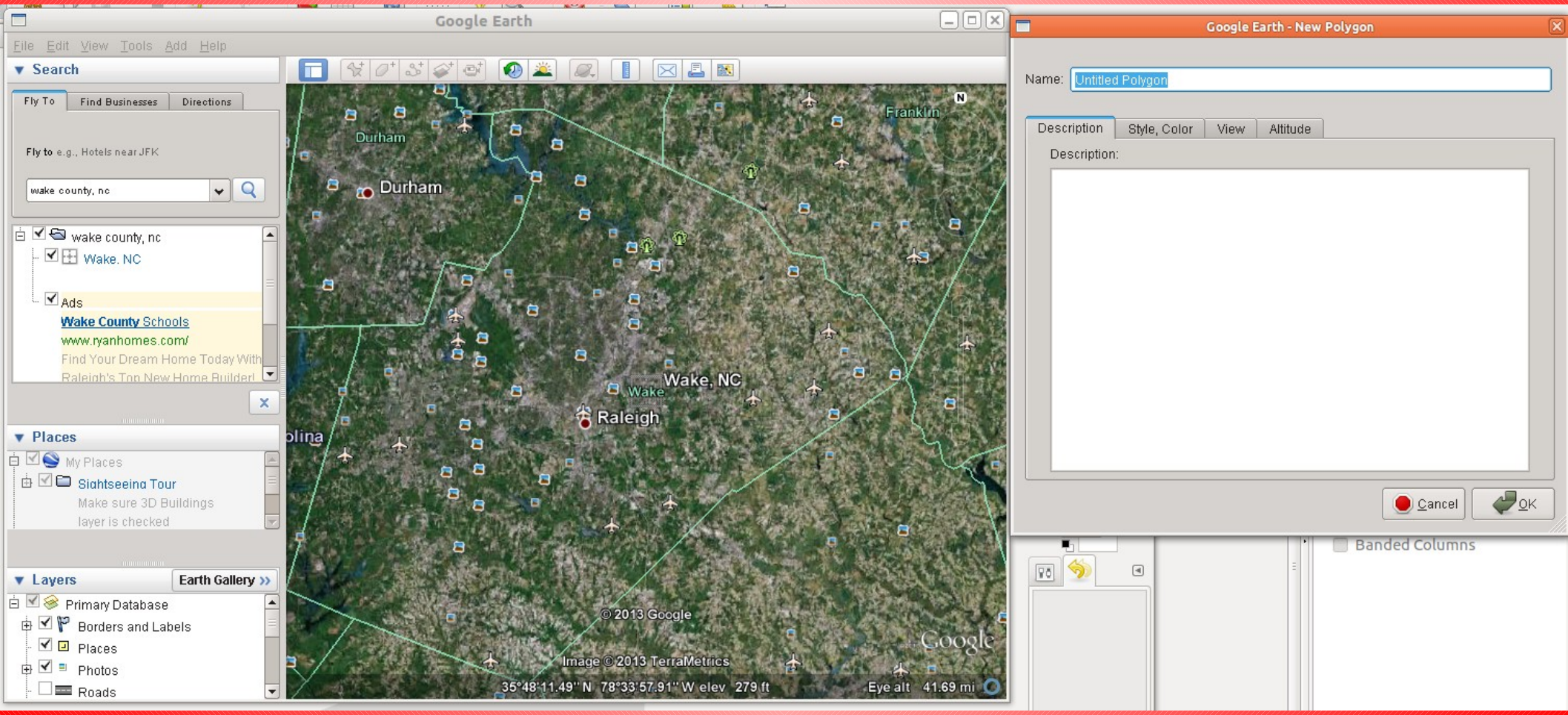
Pros:

- View imagery anywhere in the world.
- Open data format -KML, points, lines polygons
- Multiplatform - On Windows , OSX, and Linux

Cons:

- Limited analysis options
- Only uses one projection
- Limited file formats

Google earth creating a polygon



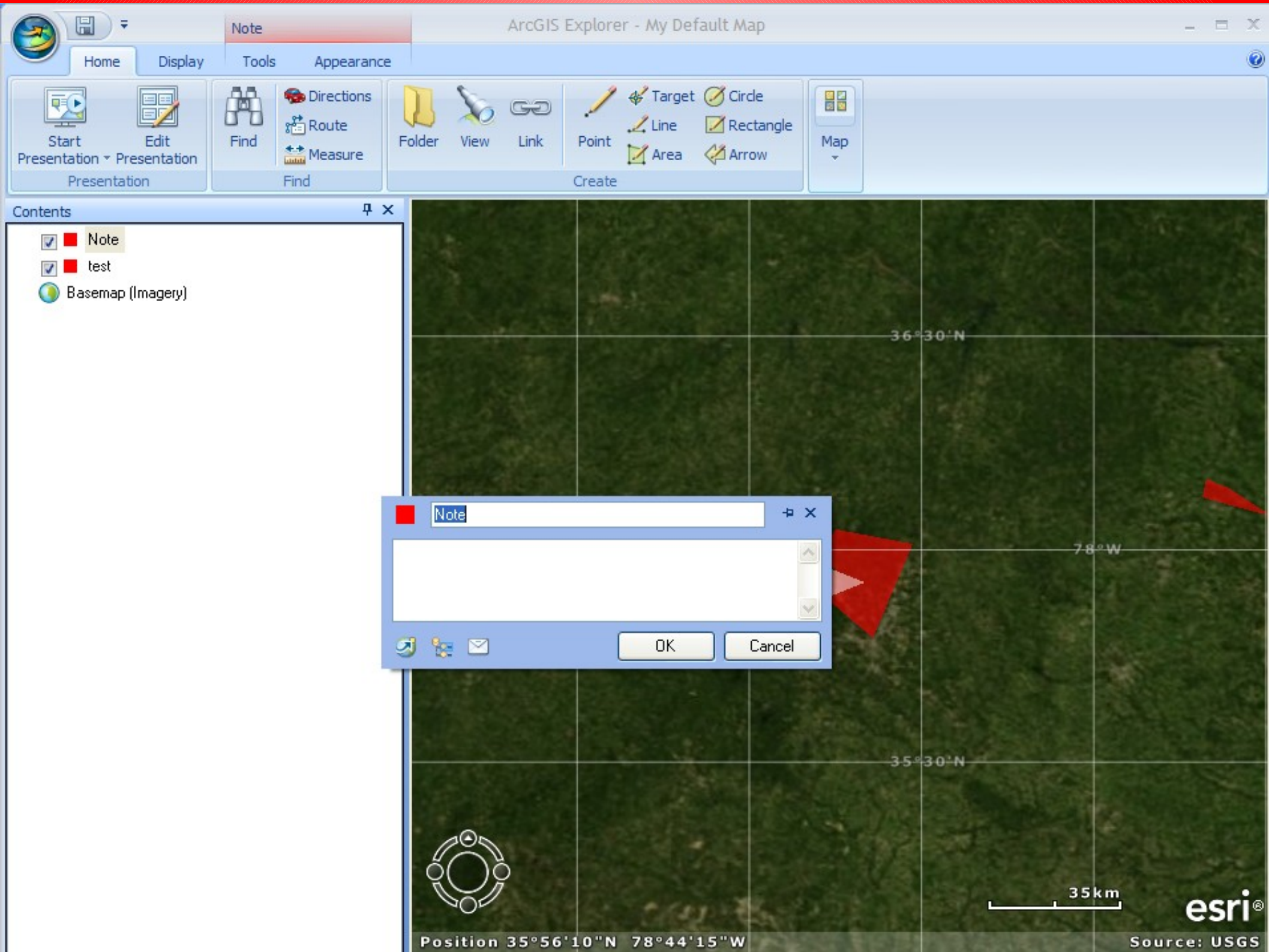
Geospatial Tools – Free Closed Source: ArcGIS Explorer

Pros:

- Ties into ESRI online services, WMS services.
- Reads several data formats (including SDE and file geodatabase.
- Some analysis tools (require connection to ArcGIS server for in dept analysis)

Cons:

- Limited analysis options (unless you have access to Arcgis server)
- Single Platform- Windows Only
- Be sure your version is in sync with the version of ARCSERVER Running ArcGIS OnLine


Note
ArcGIS Explorer - My Default Map
Home
Display
Tools
Appearance
Start Presentation
Edit Presentation
Presentation
Find
Directions
Route
Measure
Find
Folder
View
Link
Point
Target
Circle
Line
Rectangle
Area
Arrow
Create
Map
Contents
Note
test
Basemap (Imagery)
36°30'N
78°W
35°30'N
Note
OK
Cancel
35km
esri
Position 35°56'10"N 78°44'15"W
Source: USGS

Geospatial Tools – Free Open Source :GDAL and OGR

Pros:

- Swiss Army Knife of Raster and Vector data formats. http://www.gdal.org/formats_list.html
- Many useful Utility programs for vector and raster conversion.
- Library interfaces for perl, python, Java, C++
- Cross platform
- Scales to large (Multi-GB) datasets
- Common libraries to many Proprietary/Open Source GIS packages

Cons:

- Not everyone is comfortable on the command line
- Understanding the syntax takes some work.

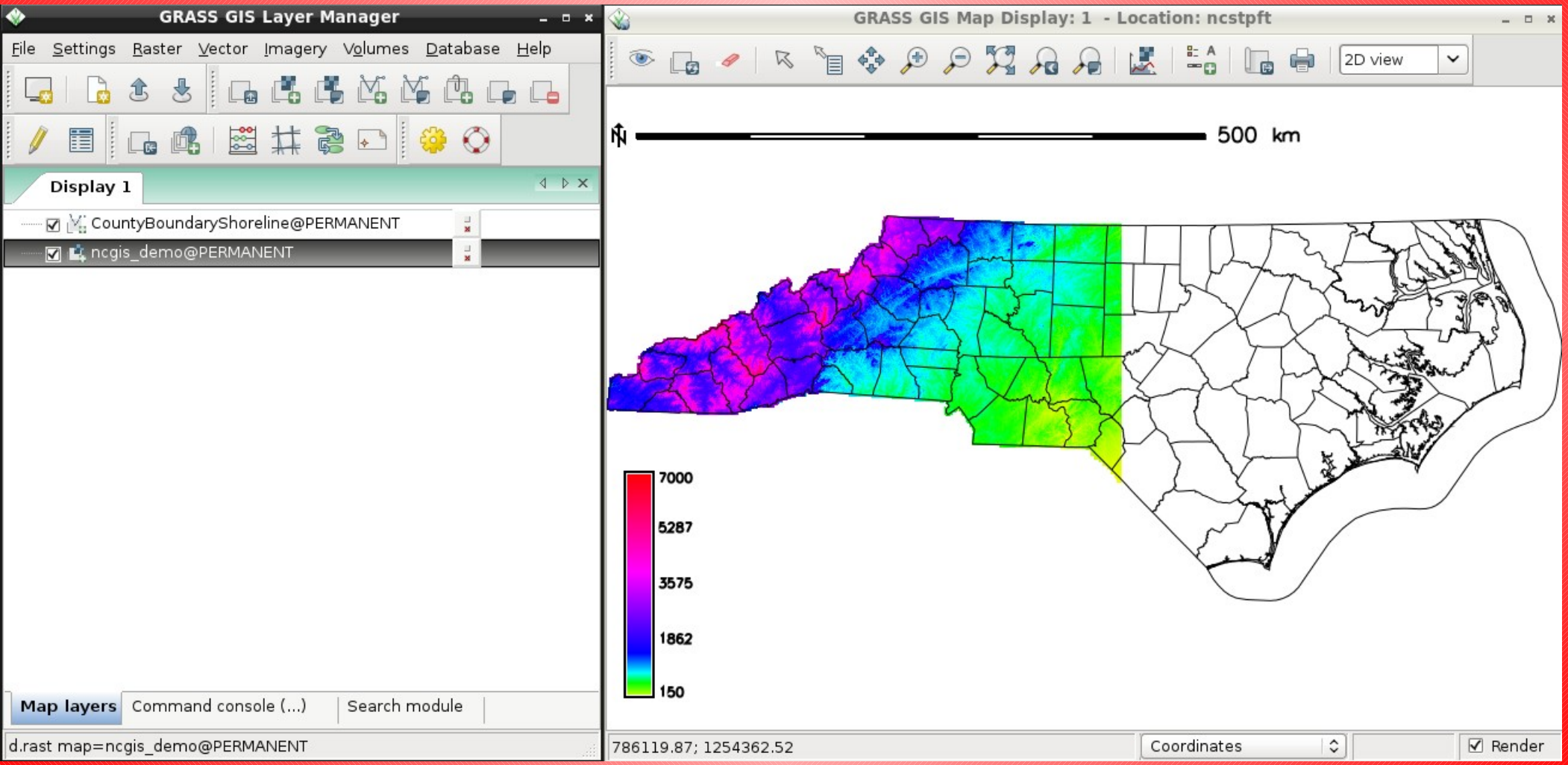
Geospatial Desktop Tools – Free and Open Source

- GRASS - http://grass.osgeo.org/
- Gvsig - http://www.gvsig.org/web/
- Openjump – http://www.openjump.org/
- Qgis – http://www.qgis.org - easy to use , works with GRASS,Montevedi, postgis, geoserver and others via plugin
- Udig - http://udig.refractions.net/
- Monteverdi/OTB - http://orfeo-toolbox.org/otb/
- Opticks - http://opticks.org/confluence/display/opticks/Welcome+To+Opticks
- R Project - http://www.r-project.org/ - statistical software with spatial functions and interfaces to databases and other GIS software.
- Saga Gis - http://www.saga-gis.org/en/index.html
- Exiftool – http://www.sno.phy.queensu.ca/~phil/exiftool/ photo geotagging

GRASS

- Windows 32-bit, Linux and OSX 64 bit
- Can handle large rasters (7 billion cells +)
- Vector network analysis
- 3d Vector and 3d Raster display and analysis
- Solar irradiation, raster algebra, hydrologic modeling, surface generation, image analysis.
- Python interface

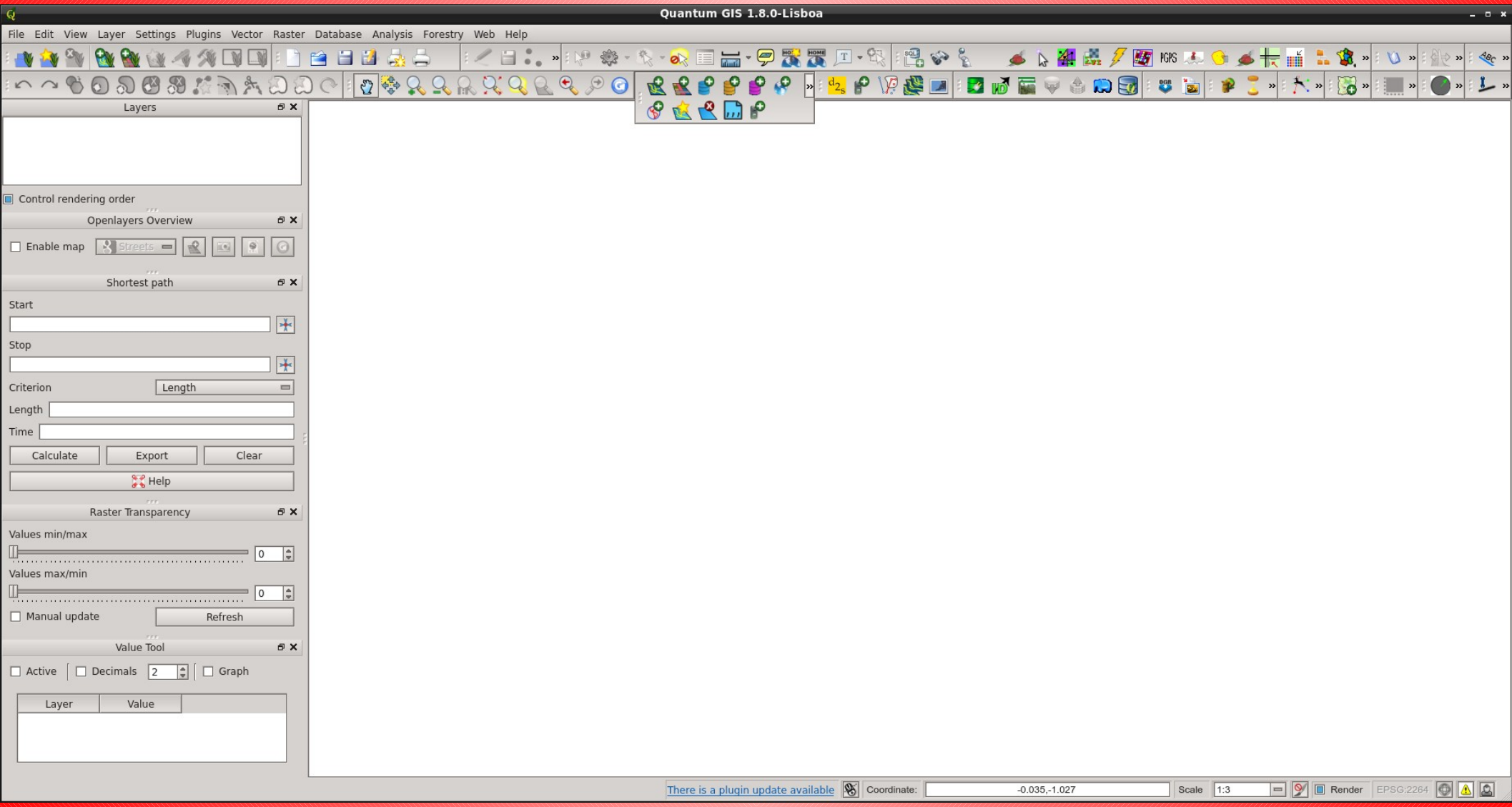
GRASS GIS with 20ft elevation grid



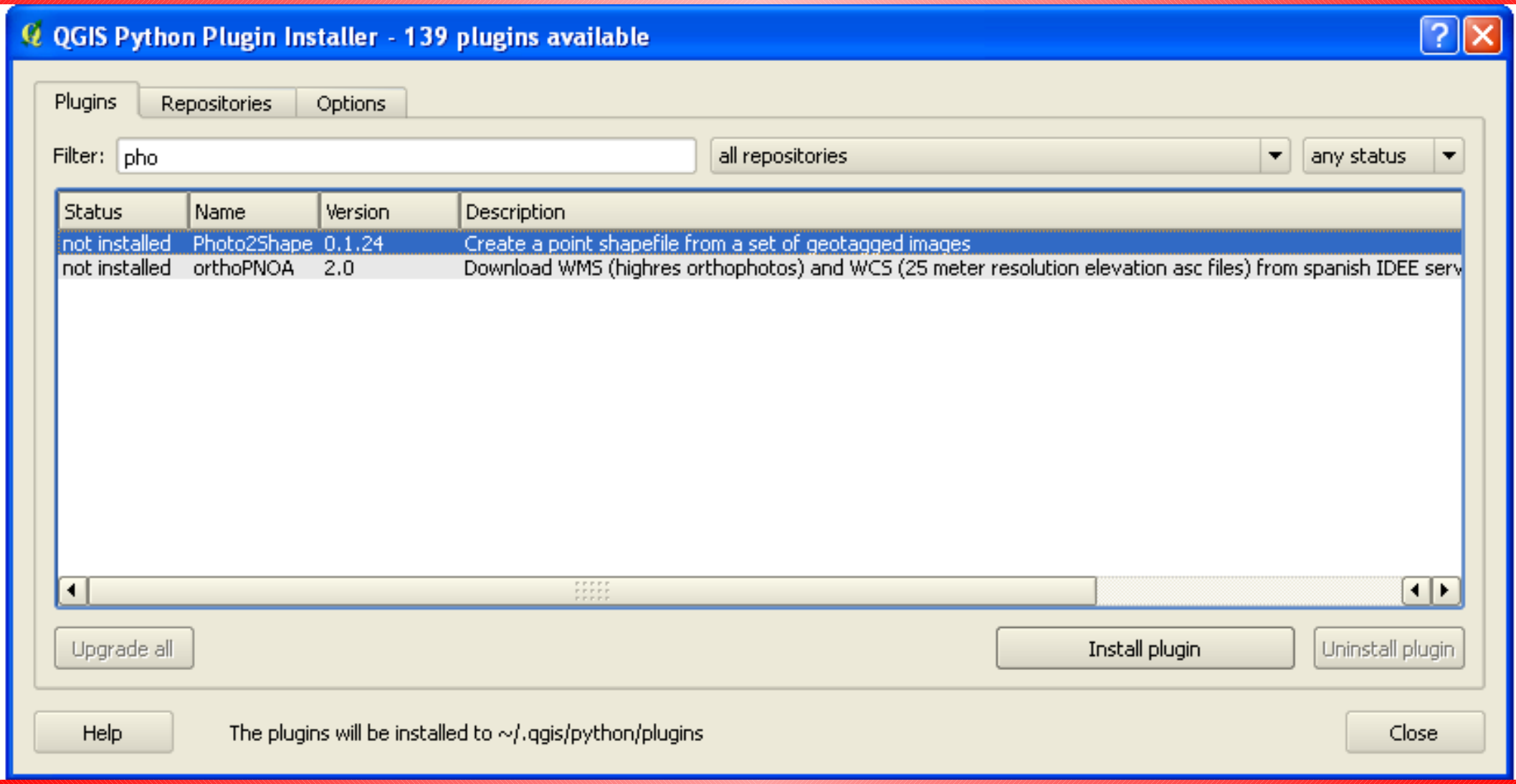
QGIS

- Windows 32-bit, Linux and OSX 64 bit
- Can open any vector/ raster data layer useable by GDAL/OGR
- Project on the fly data layers of different formats
- Native vector data formats – shapefile, spatialite
- Python/QT based scripting/module building
- Several modules prebuilt in online repositories

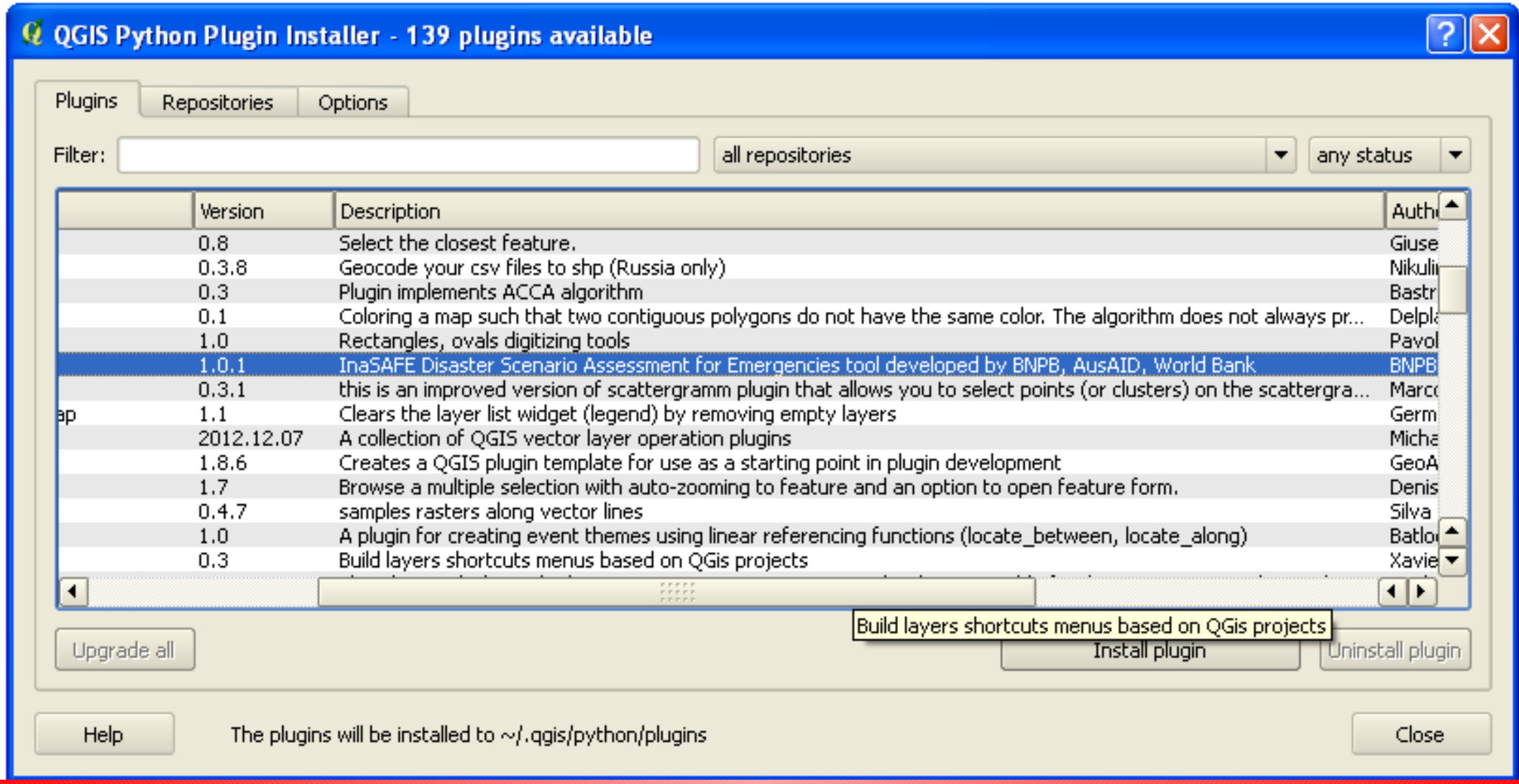
QGIS with too many plugins active

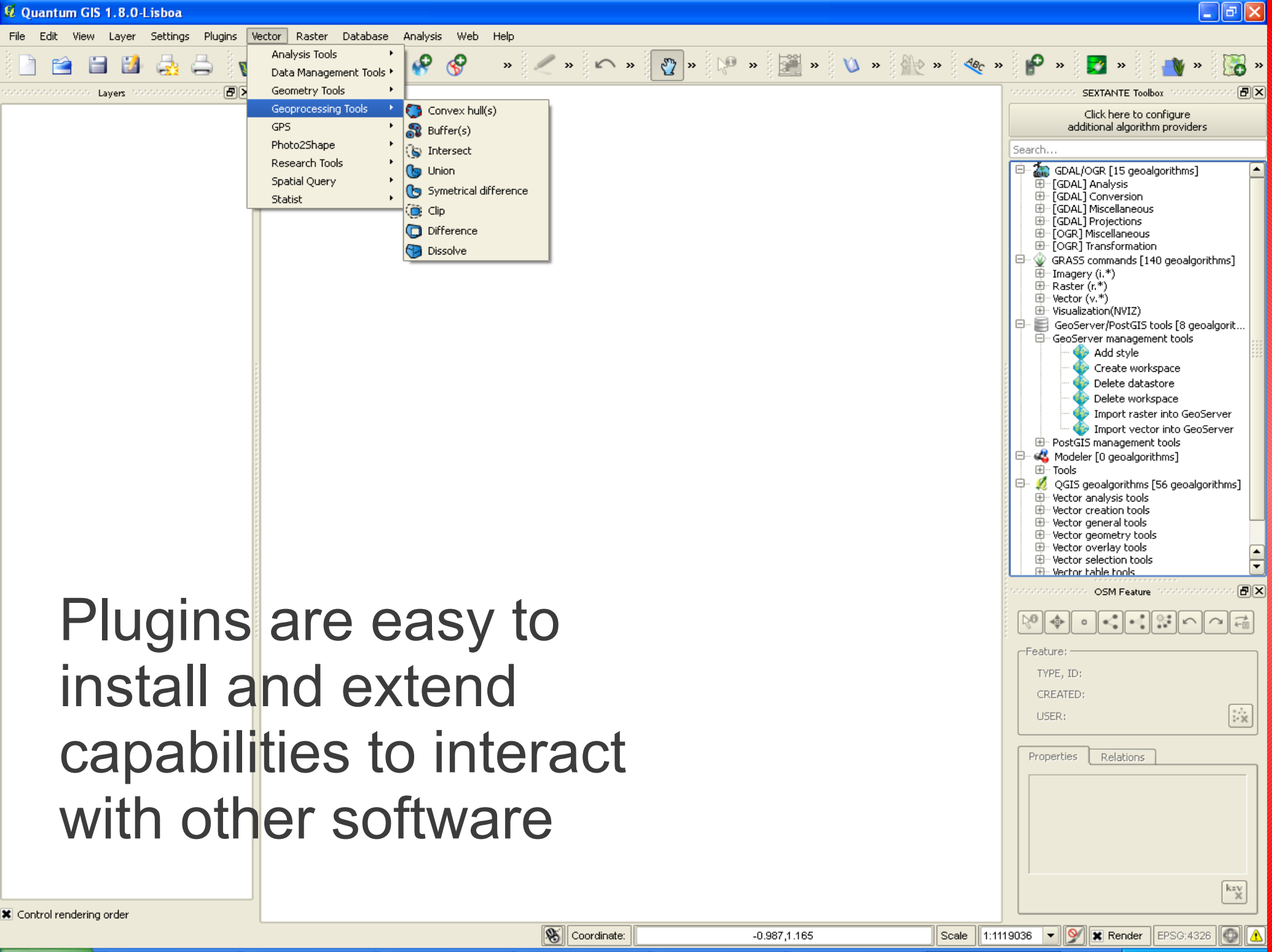


Many plugins of differing complexity, from simple

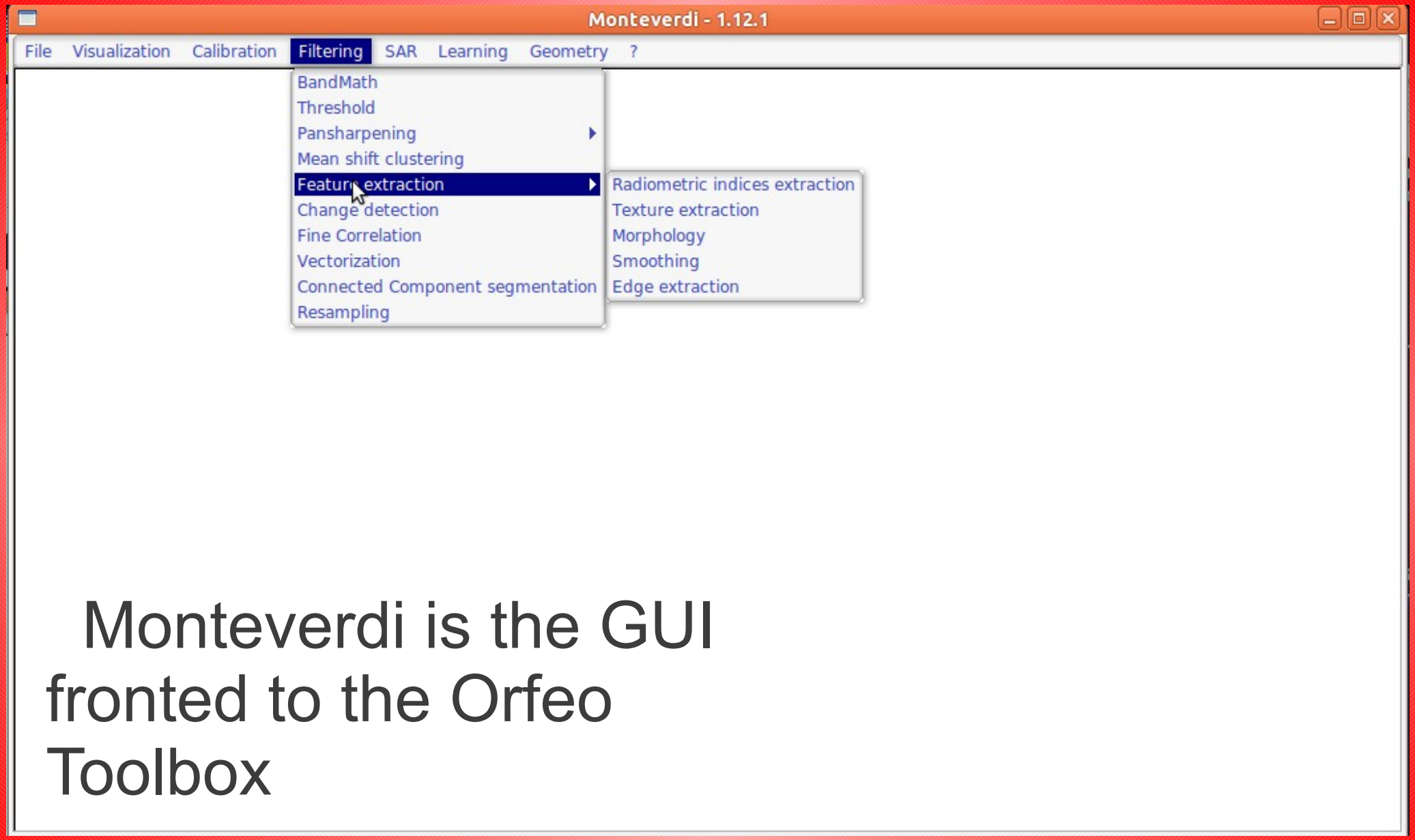


To complex


QGIS Python Plugin Installer - 139 plugins available
Plugins
Repositories
Options
Filter:
all repositories
any status
Version
Description
Auth
0.8
Select the closest feature.
Giuse
0.3.8
Geocode your csv files to shp (Russia only)
Nikuli
0.3
Plugin implements ACCA algorithm
Bastr
0.1
Coloring a map such that two contiguous polygons do not have the same color. The algorithm does not always pr...
Delpl
1.0
Rectangles, ovals digitizing tools
Pavol
1.0.1
InaSAFE Disaster Scenario Assessment for Emergencies tool developed by BNPB, AusAID, World Bank
BNPB
0.3.1
this is an improved version of scattergramm plugin that allows you to select points (or clusters) on the scattergra...
Marc
ap
1.1
Clears the layer list widget (legend) by removing empty layers
Germ
2012.12.07
A collection of QGIS vector layer operation plugins
Micha
1.8.6
Creates a QGIS plugin template for use as a starting point in plugin development
GeoA
1.7
Browse a multiple selection with auto-zooming to feature and an option to open feature form.
Denis
0.4.7
samples rasters along vector lines
Silva
1.0
A plugin for creating event themes using linear referencing functions (locate_between, locate_along)
Batlo
0.3
Build layers shortcuts menus based on QGis projects
Xavie
Build layers shortcuts menus based on QGis projects
Upgrade all
Install plugin
Uninstall plugin
Help
The plugins will be installed to ~/.qgis/python/plugins
Close



Plugins are easy to install and extend capabilities to interact with other software



Monteverdi is the GUI fronted to the Orfeo Toolbox

Data sources

- NCOnemap - http://www.nconemap.com/ index of data available for North Carolina
- USGS - http://earthexplorer.usgs.gov/ , http://waterdata.usgs.gov/nwis, http://glovis.usgs.gov/
- NRCS - http://datagateway.nrcs.usda.gov/
- Ebird and other online projects.
- NOAA - http://www.ncdc.noaa.gov/most-popular-data
- Crop data http://nassgeodata.gmu.edu/CropScape/
- U.S. Census data - http://www.census.gov/main/www/access.html
- Data.gov - http://www.data.gov/
- Local and State agencies

Data Types Proprietary:

- ESRI Personal Geodatabase – Access Based (never edit in Access!), 2 GB Limit , can be read by GDAL/OGR on Windows
- ESRI File Geodatabase – Changes every version of ArcGIS, API Available with limited functionality
- MrSID Compression – reading/decompression free , writing costs per GB
- ECW Compression – Reading possible (limited by license), Writing costs vary with method
- Shapefile – Relatively well documented (95%), defacto default vector data exchange method – tops out at 2GB
- Erdas Imagine – Well documented/reverse engineered. Good exchange format for data sets above 4 GB

Data Types Open:

- TIFF/GeoTIFF - lossless and lossey compression option, can be tiled with overviews 4GB Limit
- BigTIFF Same as TIFF with size extended to the multi-petabyte range.
- Jpeg – Can be used for imagery, or as image at a data point with Lat/Long tag in File header EXIF data. 4 GB size limit
- JPEG2000 – Better compression and larger size
- PNG – Lossless compression

Spatial Databases:

- ESRI File geodatabase – Format changes with every revision of ArcGIS, only accessible via File geodatabase API for versions 10 and above, not complete access via API. Avoid if possible, request shapefile instead.
- Spatialite – single file, serverless multi terabyte capable database , based on public domain SQLite database. New version 4 is the base technology for the proposed OGC Geopackage Standard
- Postgis/Postgresql - Cross platform open source spatial database software that works on desktop computers to multi-core servers with multi-terabyte databases.

Do I need to do Metadata?

Only if you want people to take you seriously

Thorough documentation of any activity/analysis is the cornerstone of scientific investigation

Metadata tools and instruction

- Tkme USGS http://geology.usgs.gov/tools/metadata/tools/doc/tkme.html ,older metadata format(CSDGM) but still valid
- FGDC Quick metadata guide http://www.fgdc.gov/metadata/documents/MetadataQuickGuide.pdf
- Other FGDC metadata guidance. http://www.fgdc.gov/metadata/metadata-publications-list
- New ISO Metadata format – use XML editors, http://catmdedit.sourceforge.net/
- NC metadata working group , possible template XML file , copy and edit in XML editor

NC Laws and policies pertaining to GIS

- http://www.ncbels.org/policies.html
- http://www.ncleg.net/enactedlegislation/statutes/html/bychapter/chapter_132.html

- Disclaimer: I am not a lawyer, but it appears that you can analyze anything you want for your personal use. If you are trying to set property lines or determine ground surface for hydrologic analysis, talk to a Professionally Licensed Surveyor (PLS)

Screenshots/demos

- QGIS W/ Plugins
- GRASS
- OTB Feature Extraction