Leveraging Your Geo-spatial Data Investments with Quantum GIS: an Open Source Geographic Information System

Donald L. Schrupp – Colorado Division of Wildlife (Retired)
Danny Lewis – Texas Parks and Wildlife Department
What Is Quantum GIS (QGIS) ?
“The Free and Open Source GIS”

Gary Sherman began development of Quantum GIS in early 2002, and it became an incubator project of the Open Source Geospatial Foundation in 2007. Version 1.0 was released in January 2009. Version 2.4 was just released (September, 2014).

Similar to other software GIS systems QGIS allows users to create maps with many layers using different map projections. Maps can be assembled in different formats and for different uses. QGIS allows maps to be composed of raster or vector layers. Typical for this kind of software the vector data is stored as either point, line, or polygon-feature. Different kinds of raster images are supported and the software can perform geo-referencing of images.
Quantum GIS and Related “Packages” (Overview)

* **QGIS Desktop**: The QGIS Desktop provides the graphic user interface (GUI) for doing geographic information system work using Quantum GIS software.

* **QGIS Browser**: The QGIS Browser is a panel in QGIS that lets you easily navigate in your filesystem and manage geodata. You can have access to common vector files (e.g., ESRI shapefiles or MapInfo files), databases (e.g., PostGIS, Oracle, SpatiaLite or MS SQL Spatial) and WMS/WFS connections. You can also view your GRASS data (to get the data into QGIS, see GRASS GIS Integration).
Quantum GIS and Related “Packages” (Overview)

* **GRASS GIS:** GRASS (Geographic Resources Analysis Support System) is a Software for performing spatial analysis. It consists of more than 350 modules for processing vector (2D/3D), raster and voxel data. Many interfaces to other programs in related domains like geostatistics, databases, mapserver and even other GIS software exist. It can serve as a Desktop GIS and as the backbone of a complete GIS infrastructure.

* **OSGeo4W:** the OSGeo4W project. OSGeo4W is a binary distribution of a broad set of open source geospatial software for Win32 environments (Windows XP, Vista, etc). OSGeo4W includes GDAL/OGR, GRASS, MapServer, OpenEV, uDig, QGIS as well as many other packages (over 150).
Quantum GIS Desktop - Details
Feature Tour / GUI

Project: to work with QGIS 'Projects'
Edit: to edit GIS data sets
View: to navigate around maps being viewed
Layer: to load, query GIS data layers
Settings: to set defaults for the QGIS GUI
Plugins: to use 3\textsuperscript{rd} party GIS Components in QGIS
Vector: to perform various vector operations in QGIS
Raster: to perform various raster operations in QGIS
Database: to access various Database functionalities
Processing: to access various geo-processing functions
Help: to get Help with QGIS; both built-in and online
Quantum GIS Desktop – Details - Layers:
Quantum GIS Desktop – Details – Layers: Vectors / Rasters
Quantum GIS Desktop – Details – Layers: Vectors / Rasters
Quantum GIS Desktop – Details – Layers: Vectors / Rasters – Formats Supported

Vector Formats

- ESRI Shapefiles [OGR]
- MapInfo File [OGR]
- Spatial Data Transfer Standard (SDTS) [OGR]
- S-57 Base File [OGR]
- Microstation DGN [OGR]
- VRT - Virtual Data Source [OGR]
- Atlas BNA [OGR]
- Comma Separated Value [OGR]
- Geography Markup Language (GML) [OGR]
- GPS Exchange Format [GEX] [OGR]
- Keyhole Markup Language (KML) [OGR]
- GeoJSON [OGR]
- Generic Mapping Tools (GMT) [OGR]
- X-Plane/Flightgear [OGR]
- Arc/Info ASCII Coverage [OGR]
- AutoCAD DXF [OGR]
- Geocore [OGR]
- GeoRSS [OGR]
- GDAL/OGC VSIFileHandler [OGR]
- All Files

Raster Formats

- GDAL/ArcInfo
  - [GDAL] Virtual Raster
  - [GDAL] GeoTIFF
  - [GDAL] National Imagery Transmission Format
  - [GDAL] Raster Product Format “TDC” Format
  - [GDAL] ESRI TIG Format
  - [GDAL] Erdas Imagine Image
  - [GDAL] Ground-Based SAR Applications Testbed File Format
  - [GDAL] Arc/Info Binary Grid
  - [GDAL] Arc/Info ASCII Grid
  - [GDAL] TIFF Raster
  - [GDAL] GeoTIFF Raster
  - [GDAL] TIF Raster
  - [GDAL] Portable Network Graphics
  - [GDAL] JPEG
  - [GDAL] JPEG2000
  - [GDAL] EIffel Image Format
  - [GDAL] XI FIle Format
  - [GDAL] Windows Device Independent Bitmap
  - [GDAL] PC/DSK Database File
  - [GDAL] PCMaster Raster File
  - [GDAL] IMM Raster Map
  - [GDAL] SG Image File Format 1.0
  - [GDAL] SRM/IMGT File Format
  - [GDAL] Leceller heightfield
  - [GDAL] Terragen heightfield
  - [GDAL] Gridded Binary
  - [GDAL] Raster Matrix Format
  - [GDAL] 32Bit TIFF Format
  - [GDAL] GDAL 32 Bit Grid
  - [GDAL] Golden Software ASCII Grid

- [GDAL] Golden Software ASCII Grid
- [GDAL] Golden Software Binary Grid
- [GDAL] Arc/Info ASCII Grid
- [GDAL] ESRI 3D Geospatial Processor Raster
- [GDAL] Raster Data Source
- [GDAL] Portable Raster Format
- [GDAL] EPSI Hdr Labeled
- [GDAL] Voxel NIP Raster
- [GDAL] VTP ...
- [GDAL] FARSITE v4.3 Landscape File
- [GDAL] NOAA Vertical Datum .GTX
- [GDAL] N32 Datum Grid Shift
- [GDAL] ACE 2
- [GDAL] Snow Data Animation System
- [GDAL] Swedish Grid BIK
- [GDAL] USC Geological ASCII DEM
- [GDAL] GeoSoft Grid Exchange Format
- [GDAL] Northwood Numeric Grid Format .grid/.tab
- [GDAL] Northwood Classified Grid Format .grid/.tab
- [GDAL] ASCII Digital Raster Graphics
- [GDAL] Standard Raster Product
- [GDAL] Mapgen Dspi
- [GDAL] VSA GIS Binary Grid
- [GDAL] ASCII Grid X/Y/Z
- [GDAL] HDF/HDF2 Heightfield raster
- [GDAL] Geospatial PDF
- [GDAL] Arc/Info Export E00 GRID
- [GDAL] Zmap Plus Grid
- [GDAL] Northwood Grid Height Grids
- [GDAL] IRS Grid
Quantum GIS Desktop – Details – Layers: **Vectors** – Web Mapping Services (WMS)

National Atlas Example

**National Atlas Web Map Services Introduction**

We've recently updated our Web Map Services (WMS), and a brief description of the updated WMS follows. If you’re already WMS savvy, you might simply want to go to one of the step-by-step instructions below for viewing our WMS in popular mapping programs.

- The National Map viewer
- Esri ArcGIS
- Intergraph GeoMedia
- Google Earth
- Quantum GIS

**Exploring Emerging Technological Tools and Solutions for Common Fish & Wildlife Information Management Challenges**

2014 Annual OFWIM Conference
September 28—October 2, 2014
Flagstaff, Arizona

<table>
<thead>
<tr>
<th>Category</th>
<th>URL</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Million-Scale Map Layers</td>
<td><a href="http://webservices.nationalatlas.gov/wms/1million?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/1million?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>41 KB</td>
</tr>
<tr>
<td>Agriculture</td>
<td><a href="http://webservices.nationalatlas.gov/wms/agriculture?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/agriculture?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>33 KB</td>
</tr>
<tr>
<td>Boundaries</td>
<td><a href="http://webservices.nationalatlas.gov/wms/boundaries?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/boundaries?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>16 KB</td>
</tr>
<tr>
<td>Climate</td>
<td><a href="http://webservices.nationalatlas.gov/wms/climate?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/climate?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>100 KB</td>
</tr>
<tr>
<td>Environment</td>
<td><a href="http://webservices.nationalatlas.gov/wms/environment?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/environment?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>24 KB</td>
</tr>
<tr>
<td>Geology</td>
<td><a href="http://webservices.nationalatlas.gov/wms/geology?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/geology?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>51 KB</td>
</tr>
<tr>
<td>History</td>
<td><a href="http://webservices.nationalatlas.gov/wms/history?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/history?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>12 KB</td>
</tr>
<tr>
<td>Map Reference</td>
<td><a href="http://webservices.nationalatlas.gov/wms/map_reference?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/map_reference?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>12 KB</td>
</tr>
<tr>
<td>People</td>
<td><a href="http://webservices.nationalatlas.gov/wms/people?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/people?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>456 KB</td>
</tr>
<tr>
<td>Transportation</td>
<td><a href="http://webservices.nationalatlas.gov/wms/transportation?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/transportation?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>22 KB</td>
</tr>
<tr>
<td>Water</td>
<td><a href="http://webservices.nationalatlas.gov/wms/water?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms/water?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>144 KB</td>
</tr>
<tr>
<td>All Layers</td>
<td><a href="http://webservices.nationalatlas.gov/wms?SERVICE=WMS&amp;REQUEST=GetCapabilities">http://webservices.nationalatlas.gov/wms?SERVICE=WMS&amp;REQUEST=GetCapabilities</a></td>
<td>5.46 MB</td>
</tr>
</tbody>
</table>

Table 1: Summary of National Atlas Capabilities Files

National Atlas Example

There are two ways you can view National Atlas layers using the National Map Viewer:

**The "Search Box" Method**
2. In the Search box at the top of the page, copy and paste one of the GetCapabilities URLs from Table 1. Be sure to append the version parameter to the URL (for example, "&version=1.1.1"). The version should be 1.1.1. Here is an example of a complete URL: http://webservices.nationalatlas.gov/wms/agriculture?SERVICE=WMS&REQUEST=GetCapabilities&VERSION=1.1.1
3. Click the Search button (or press the Enter key).
4. In the Overlays panel, expand the category headings to view the list of layers, and check or uncheck the desired layers.

**The "Add Data" Method**
2. Click on the Advanced tab.
3. Click on the Add Data button.
4. Click on the WMS button.
5. Copy and paste one of the GetCapabilities URLs from Table 1. Be sure to append the version parameter to the URL (for example, "&version=1.1.1"). The version should be 1.1.1. Here is an example of a complete URL: http://webservices.nationalatlas.gov/wms/agriculture?SERVICE=WMS&REQUEST=GetCapabilities&VERSION=1.1.1
6. Click the Add Data button.
7. In the Overlays panel, expand the category headings to view the list of layers, and check or uncheck the desired layers.

National Atlas Example

Viewing the National Atlas WMS in Esri ArcGIS

Viewing the National Atlas WMS in Intergraph GeoMedia

Viewing the National Atlas WMS in Google Earth

Viewing the National Atlas WMS in Quantum GIS

1. Position the 3D viewer in the location where you want to place the overlay image file.
2. Click Add > Image Overlay or click the Image Overlay button. The New Image Overlay dialog box appears.
3. In the New Image Overlay dialog box, click the Definition tab.
4. Click WMS.
5. Click the WMS Settings button.
6. Copy and paste the URL for the WMS service into the URL text box. For example, "http://services.nationalatlas.gov/wms/agriculture?SERVICE=WMS&REQUEST=GetCapabilities".
7. Enter a descriptive name for the layer.
8. In the Layers tab, click the New button. This will display the Create a New WMS connection dialog box.
9. Enter a descriptive name in the Name text box.
10. In the URL text box, copy and paste one of the GetCapabilities URLs from Table 1 (for example, "http://services.nationalatlas.gov/wms/agriculture?SERVICE=WMS&REQUEST=GetCapabilities").
11. Click the OK button to add the new connection.
12. In the Add Layer(s) from a Server dialog box, click the Connect button.
13. Select the layer(s) you want to add, and then click the Add button.
14. When you are done adding layers, close the Add Layer(s) from a Server dialog box by clicking the Close button.

Exploring Emerging Technological Tools and Solutions for Common Fish & Wildlife Information Management Challenges
2014 Annual OFWIM Conference
September 28—October 2, 2014
Flagstaff, Arizona
Quantum GIS Desktop - Details
Print Composer
Quantum GIS Desktop - Details
Plugins - Overview
Starting from 0.9 release, QGIS has optional scripting support using Python language. We’ve decided for Python as it’s one of the most favourite languages for scripting. PyQGIS bindings depend on SIP and PyQt4. The reason for using SIP instead of more widely used SWIG is that the whole QGIS code depends on Qt libraries. Python bindings for Qt (PyQt) are done also using SIP and this allows seamless integration of PyQGIS with PyQt.
Quantum GIS Desktop - Details

Help: Built-In (context sensitive)
Quantum GIS Desktop - Details

Help: Online Help

Get started using QGIS

QGIS is a cross-platform, Open Source Geographic Information system with an International support community of enthusiastic users, developers and supporters.

FOR USERS

Download QGIS Plugins Documentation Features Getting Help In the Press Commercial Support
Quantum GIS Desktop - Details

Help: the QGIS Community

QGIS Support

Mailing Lists
QGIS has a bunch of mailing lists. See Mailing lists for the different available lists.
If you are going to ask questions please read this: How to ask a QGIS question.

Searchable Mailing Lists
Nabble ([http://nabble.com](http://nabble.com)) keeps a history of a lot of mailing lists.
If you go to the osgeo section of it: [http://osgeo-org.1560.xs.nabble.com/](http://osgeo-org.1560.xs.nabble.com/) you see there is a QGIS section also, where you can do a search over all QGIS lists, or refine it to eg only the users list.

Forums
QGIS does not have a forum. Please either search in StackExchange (see below), or via Nabble. In the history of our Mailing lists (see above).

StackExchange
On [http://gis.stackexchange.com](http://gis.stackexchange.com) you can ask QGIS questions also. If you use the tag 'qgis' you'll see all QGIS related questions and answers. [http://gis.stackexchange.com/?tag=ogis](http://gis.stackexchange.com/?tag=ogis)
Quantum GIS – Browser
Feature Tour
The OSGeo4W Project: OSGeo4W is a binary distribution of a broad set of open source geospatial software for Win32 environments (Windows XP, Vista, etc). OSGeo4W includes GDAL/OGR, GRASS, MapServer, OpenEV, uDig, QGIS as well as many other packages (over 150).
Quantum GIS – Application Examples

Aquatic: Lake Avery; Gill Netting Sampling and Alligatorweed Mapping

<table>
<thead>
<tr>
<th>Fish ID</th>
<th>Fish Species</th>
<th>Species Code</th>
<th>Number Of Fish</th>
<th>Length</th>
<th>Weight</th>
<th>Age</th>
<th>Tag No</th>
<th>Fish Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1896875</td>
<td>White bass</td>
<td>109</td>
<td>1</td>
<td>418</td>
<td>1117</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1896876</td>
<td>White bass</td>
<td>109</td>
<td>1</td>
<td>407</td>
<td>916</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1896877</td>
<td>White bass</td>
<td>109</td>
<td>1</td>
<td>406</td>
<td>964</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1896878</td>
<td>White bass</td>
<td>109</td>
<td>1</td>
<td>403</td>
<td>1040</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1896879</td>
<td>White bass</td>
<td>109</td>
<td>1</td>
<td>427</td>
<td>1392</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1896880</td>
<td>Channel catfish</td>
<td>B6</td>
<td>1</td>
<td>370</td>
<td>277</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1896881</td>
<td>Channel catfish</td>
<td>B6</td>
<td>1</td>
<td>414</td>
<td>907</td>
<td>0</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>1896882</td>
<td>Channel catfish</td>
<td>B6</td>
<td>1</td>
<td>285</td>
<td>214</td>
<td>0</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>1896883</td>
<td>Channel catfish</td>
<td>B6</td>
<td>1</td>
<td>525</td>
<td>1533</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Survey ID | District | Water Body | Lake Code | Gear Used | Gear Code | Day or Night | Electro | Survey Date | Survey Year | Objective | Sample Design |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B165</td>
<td>3C</td>
<td>Athens</td>
<td>33</td>
<td>Gill Net</td>
<td>1</td>
<td>NA</td>
<td>3/12/2014</td>
<td>2012</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B166</td>
<td>3C</td>
<td>Athens</td>
<td>33</td>
<td>Gill Net</td>
<td>1</td>
<td>NA</td>
<td>3/12/2014</td>
<td>2012</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B167</td>
<td>3C</td>
<td>Athens</td>
<td>33</td>
<td>Gill Net</td>
<td>1</td>
<td>NA</td>
<td>3/12/2014</td>
<td>2012</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Survey Notes
- B166 3/17/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/18/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/19/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/20/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/21/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/22/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/23/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/24/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/25/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/26/2014: Numbers in user field correspond to tissue samples not age and growth
- B166 3/27/2014: Numbers in user field correspond to tissue samples not age and growth

Station ID | Station No | Station Date |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11.3646104333</td>
<td>3.3850249</td>
<td>238853.2969312</td>
</tr>
</tbody>
</table>
Quantum GIS – Application Examples

Terrestrial: Ortho Imagery, GNIS Places, USGS DRGs, Field Sites from GPS
Quantum GIS – Application Examples

Terrestrial: Ortho Imagery, GNIS Places, USGS DRGs, Field Sites from GPS
Quantum GIS – Application Examples

Terrestrial: Ortho Imagery, GNIS Places, USGS DRGs, Field Sites from GPS
Quantum GIS – Application Examples
Terrestrial: USGS DRGs, Field Sites from GPS
THANKS …
to the Quantum GIS Community for developing
and making available these wonderful tools!

Just some of the QGIS Developers
– at the Essen, Germany 2012 Developers Meeting
and further THANKS …

to the the other geospatial developers on whose shoulders the QGIS folks stand upon …

GRASS GIS
GDAL/OGR
PROJ4
MapServer
The Open Source Geospatial Foundation
and many more!
Questions?